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THE AMERICAN

GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LV.—No. 8.
Whole No. 846.

NEW YORK, MONDAY, AUGUST 24, 1891.

$3 PER ANNUM,
IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y. AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

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A PROPOSED NEW ASSOCIATION.

We are in receipt of a circular (which is reprinted below) from Mr. Frederick H. Shelton, Manager of the Natural Gas Light and Fuel Company, of Chicago, which goes to show that the gas men of our Western metropolis are about to organize an Association or Society to be modelled, perhaps, on the lines that constitute the framework of the Society of Gas Lighting, or of the Guild of Gas Managers. At the outset we may say that the JOURNAL is most heartily in favor of the project, and we believe that such a Society cannot fail to be of great and permanent benefit to its membership and to those whom they will influence. No one can successfully maintain against a belief which holds that the best way to determine each other's merits and worth is to meet one another in a semi-social, semi-technical conclave. where the arguments advanced by each are subject to criticism at—may we say—short range. Those acquainted with the workings of the Society of Gas Lighting and the Guild of Gas Managers as well, will fully appreciate the meaning of the prior sentence, and all will concur in the verdict that these two bodies have done great good for the gas fraternity of the East. That which has been so successful here must of necessity be equally successful in any other section of the country when the mainspring that makes the purpose is the same. Gas men are all pretty much alike, and for the last dozen years unanimity has prevailed fairly well in their councils. Of course, it is not the intention of those who have charge of this project, as a preliminary committee, to confine the membership to residents of Chicago, for it will be noted that the circular is quite elastic in its hints as to the district from which membership may be expected. It would seem rather crude at this time to make objection to any of the timbers in the platform, so far as these have been hewn, but we hope that some more appropriate title than that of the "Associated Chicago Gas Men" will be selected on the baptismal day—or night. Those who have not personally received a copy of the circular are to understand that its publication in the JOURNAL can be fully accepted by them as a special invitation to reply to its queries, for the committee may, but only through an oversight, fail to notify all whom they would like to have an expression of opinion from. The circular is appended:

CHICAGO, August 15, 1891.

Dear Sir—A recent informal gathering of local gas men proved so agreeable that it was suggested that it might be a good thing if the gas men in Chicago would unite and form a permanent organization.

That there are numerous men directly allied with the gas industry in the city is well known. Other gas men, located near, constantly come to Chicago for supplies, etc. It is felt that the number of such is sufficiently large to warrant the formation of a small local club or association, and to make such a success.

In Boston the congeniality of local gas men, largely the result of the Guild of Gas Managers there existing, is almost proverbial. In New York the Society of Gas Lighting has served a similar purpose for yea It would seem as though Chicago has reached the time where, from it s size and the territory tributary to it, it could readily support an organization similar to those above with much benefit and pleasure to its members.

It is proposed to unite under the name of "The Associated Chicago Gas Men." Meetings, probably once a month, would be the immediate feature,

and it is hoped to make them so attractive as to secure the attendance of all the local gas men, and to induce those living out of town to plan their visits to the city at such times as to take in the meetings. At intervals special visits by the members in a body would be planned, to gas, electric and industrial plants near by, to inspect new processes, to places of entertainment, etc. At other times papers and talks and discussions upon live gas topics would be provided for. A summer outing by the gas men in a body, of two days or so upon a steamer on the lakes, has been suggested for the immediate future, say about the middle of September. During the winter it is hoped to have "a dinner" occasionally, and to be able to provide a permanent room as headquarters, where a bulletin-board, sundry information, the gas journals, etc., will always be on file; where mail may be sent, where a gas man may be apt to find another, and where outside gas men, it is hoped, visiting Chicago, will soon learn to visit as a matter of course.

In this connection it is felt that such an organization as is contemplated could be of great local assistance to the general committee on "Worlds Fair" from the several Gas Associations and could most fittingly represent local gas interests and the city of Chicago at that time.

Membership with "The Associated Chicago Gas Men" is to be open to every one who may be reasonably connected with the gas business or its allied industries. Engineering and commercial interests are alike invited, and good fellowship with all will be the keynote and the chief credential required.

Annual dues will be moderate and sufficient only to cover the cost of stationery, printing announcements, etc., or whatever expense may be decided upon to be incurred.

The cost of entertainments will be borne pro rata by the members attending, and the probable expense of this will in each case be indicated by the Secretary beforehand. It is the idea *not* to make membership onerous in a financial way in any respect.

It is especially to be noted that the organization herein contemplated is not in any sense intended to, and will in nowise conflict with, the Western or any other of the regular gas associations. It is to be primarily and purely an informal uniting for local and social purposes.

It is believed that, with the cooperation of most of the gas men centering in Chicago, it will prove a success.

Are you in favor of the project?

The undersigned have consented to act as a preliminary committee upon the matter. Will you kindly (and promptly) write your views upon the subject to the Temporary Secretary below?

If a sufficient number of favorable replies are received a meeting will be called at an early date for organization, etc.

In answering please also mention the names of all of those that you know that you think would be interested. It is desired to reach every available man. Very truly,

FRED R. PERSONS, F. H. SHELTON. } Temporary Committee.

In answering please address,

F. H. SHELTON, Temporary Secretary,
52 Lake street, Chicago.

A CORRESPONDENT at Wakefield, Mass., among other things, writes: "Friends of Colonel Woodward, late President of the Citizens Gas Light Company, of Wakefield, will regret the emergency that caused him to step down and out. Colonel Woodward assumed the office about a year ago, having interested himself financially in the Company. He has worked conscientiously for the benefit of the town as well as for his own interests.

NOTES.—"A.," writing from St. Paul, Minn., under date of August 17th, says that "Dan. Russell left his home in peaceful St. Louis to 'go 'way up north' to superintend some work which his firm are constructing. In his times of leisure Dan. had a good deal to say about his knowledge of sailing boats, and about yachting and all that sort of thing. Well, yesterday, Dan. had his opportunity to 'practice what he preached.' Twice did he make a start and twice did the man in charge of the float have to go to his rescue. However, he now has the title of Captain—the boatman conferred the title—but, strange to say, Dan. now insists that he is neither a captain nor a sailor, and is utterly unable to tell the difference between a sloop and a war vessel. There are some though, who claim that he knows a good deal about 'schooners.'"——The La Crosse (Wis.) Gas Company's business, under the careful management of Mr. George McMillan, continues to grow.——Uncle Jerry Howard will very shortly be again identified with the gas industry, and the Western Association will have him at muster roll, as of yore.——President A. A. Smalley, of the Citizens Gas Light Company, of Newark, N. J., has offered to perform the public lighting of the adjoining town of Orange for the sum of $17,500 per annum, on the basis of a 3-year contract. The bid of the Essex County Electric Light Company, for arc lamps, amounts to $25,184.50.

Labor Saving Appliances for Gas Works.

[A paper read by Mr. John West before the North British Association of Gas Engineers. Reprinted from the London *Journal*.]

Gentlemen—My first duty is to thank you for the honor your Council has conferred upon me by inviting me to read a paper before this Association upon the adaptability of machinery for various sized gas works. I believe this invitation was the outcome of a visit of inspection made by your Committee of Investigation to the Aberdeen Gas Works, where my cannel breakers and the rope-power system of charging and drawing machinery have been in satisfactory operation for about eight months. The vital importance of this subject is being acknowledged by the great majority of engineers. All modern gas works are being arranged for the introduction of machinery for carrying on the various operations, with a view to the economy of labor; and inasmuch as the subject I am dealing with embraces that department in a gas manufactory in which the greatest number of men are employed at the highest rate of pay, on account of the arduous nature of the work, it has received the attention of gas engineers from the earliest years of the industry.

It may be interesting for you to know that my first experiments in machine stoking were made with a retort open at both ends; the mouthpiece at one end being sufficiently long to hold a charger, which was supplied with coal from a hopper fixed on the top of the mouthpieces—the charger-rod passing through a stuffiing-box in the mouthpiece lid. The front end of the charger was provided with a movable plate, which performed the service of pushing the coke forward into the chamber at the far end; the coal being deposited while the charger was being withdrawn. The results of the preliminary experiments induced me in the year 1873 to take out a patent for this method of stoking; but after a lengthened experience, when working on a practical scale, and a careful testing and consideration of its advantages and disadvantages, I came to the conclusion that the results obtained would not warrant an extension of the system. The advantages of mechanism for distributing the coal in the retort and pushing out the coke were, however, so apparent that I turned my attention to securing them by avoiding the drawbacks of my first methods.

I then decided to put up a bench of short retorts in the ordinary way, except that I had a mouthpiece at each end; the one at the farther end of the retort being for the removal of the coke. Then I devised a traveling trolley running upon rails in front of the retorts; and within the framework of the trolley was contained a hopper for carrying the coal, as also the charger for pushing out the coke and distributing an even layer of coal in the retort. This scheme, after a long experience of its working, appeared a success. As far as the mechanical arrangements were concerned, it undoubtedly was so, and several of my engineering friends advised me to erect larger retorts upon a more extended scale. In consequence of this advice, I had erected two beds of seven ⏛ retorts, each 21 in. by 15 in. by 11 ft. long; and to ensure the perfect arrangement of these settings, a London engineer kindly lent me his foreman and another retort-setter to erect them. Attached to these beds were a separate condenser, exhauster, purifier, meter, and gas holder, with the most modern apparatus for testing purposes.

In addition to a new traveling trolley with a combined charging and discharging machine, I now used for the first time coal breaking and elevating machinery to supply the charging apparatus. The machinery worked in a most satisfactory manner; but to our surprise we could not get the retorts hot enough to burn off as much coal as we anticipated and had a right to expect. After consideration, we came to the conclusion that the setting was defective, and we tried to improve it. But we still failed to get sufficient heat; so we pulled out the retorts, and rebuilt them upon the same plan as other settings which were giving good results on the old system, and started to work again. To our utter astonishment, we had no better results as regards the heating of the retorts, especially for 2 ft. from the outlet end. I pointed this out to many of my friends, but they could only suggest again that the retort setters must be at fault. From further observations I was induced to believe that I had discovered the cause. I therefore decided to block up the retorts with 14 in. of brickwork; and I was very glad to find that my surmises were correct. In a few hours the increase of heat became pronounced; and in the course of a few days I obtained excellent returns, and commenced to get better results than I had ever been able to produce, or had heard of, as regards make per ton, illuminating power, and saving in labor. This I attributed to retaining in the setting the heat previously sacrificed or lost by radiation through the additional mouthpiece for the exit of the coke (to which I shall refer later on), to the breaking and elevating of the coal, and the even distribution

thereof in the retort. I had also diminished the arduous labor of the stoker, prevented the necessity of his working so close to the retort, and provided him with a screen from the fierce heat; leaving him nothing to do but simply turn a handle to fill the charger, then run it in, turn the scoops over, and withdraw it from the retorts. This, gentlemen, is how my manual machinery was first brought out. The increase in volume and illuminating power, with the economy that resulted in its working, realized my utmost expectations; and the fact of its being so simple, with few working parts, and consequently very little wear and tear, has no doubt been the cause of its great success.

Upon the results of experiments made by the late Mr. F. W. Hartley and others, the Maidstone Gas Company decided to apply the system to their works as fast as the old ovens were worn out. Their lead was soon followed by Richmond, Portsmouth, Ipswich, and others; and at the present time we have supplied 21 gas works with manual machinery (this is exclusive of those supplied with power machinery), having had duplicate orders from four, triplicate orders from two, and quadruplicate orders from one of the above gas works.

Before going into the question of cost and saving, allow me to give you a short description of the apparatus as it now is. I found that, in order to make the machinery work successfully, it was necessary to have the coal of uniform size, and conveyed from the coal stores into the charging scoop at a minimum cost. To accomplish this I designed a coal breaker, elevator, and conveyors to carry the broken coal into the retort house; and I provided fixed store hoppers in such a position that the machines traveled under them. By having an adjustable hopper in the charging machine, capable of carrying sufficient coal for a dozen or more charges, with a frame attached for carrying the charger, the item for coal trimming and coal wheeling was reduced to an exceedingly low figure. It is an advantage, in designing new retort houses, to erect coal stores on each side of the retort house; and, if possible, provision should be made for an overhead railway running through them, so that the coal can be tipped direct from the truck into the coal breaker by opening the doors at the sides or bottom, or by lifting the wagon up by the buffers at one end, and letting the coal run out at the other, as in the case of the Oldham arrangement. Mr. E. Baker, of Reading, designed a somewhat similar arrangement for his retort house in connection with my machinery.

The position of the coal stores in relation to the retort house in works already erected, is no bar whatever to the application of machinery, for the comparative saving in labor is greater in those works where the stores are separated and at a distance from the retort house, by using a system of conveyors, as illustrated in the case of Folkestone, Belfast, Cheltenham, Sheffield, Birmingham, etc.; thus dispensing altogether with the serious item of coal wheeling. Indeed, it is in this direction that a greater portion of the saving is effected—a fact which I recognized when first attempting to deal with the question of labor saving appliances in the retort house.

This machinery has been found most suitable for small and moderate sized retort houses, and is known as the manual charging and drawing machines. These machines have, I believe, been brought to a state as near perfection as they can be, if we may judge from the fact that they have undergone very little alteration during the past few years, and have given universal satisfaction wherever they have been installed. As is well known, they depend more on the strength of the stoker than do the other classes of machinery; but the skill required to work them is even less than with the power machines, as there are only a few simple movements to be made, and less mechanism to look after. The charger I use with these machines deposits in the retort the most perfect layer of coals that it is possible to imagine, and renders bad charging by unskilled men quite out of the range of possibility. Indeed, an expert man is far more likely to charge badly than a novice, because he learns tricks to save time by not letting the charger run its full course, or by turning the scoops over before the proper time. The saving in the cost of labor by these manual machines is such as to justify me in urging their universal adoption in all gas works where there are not sufficient retorts to employ economically the more costly power machines. I scarcely think it necessary to describe the methods of operation of these machines, as the models and photographs before you will illustrate them better than pages of description.

The next step in the development of the present power machine was the addition of the necessary parts for working the manual machine by compressed air. The machines first made were but little different to the manual kind; but additional strength was found necessary, and was added, step by step, as the power was increased, until the compressed air machines differ but little from those driven by other powers. The transmission of power by compressed air has many excellencies to recommend it. The first machinery of this kind was erected at the Rochdale Road works of the Manchester Corporation in 1881, and is still doing good work on a large number of retorts. The compressed air is delivered to the machines from a fixed hose reel by flexible hose. Many sets of this kind of machinery are working—including Manchester, South Metropolitan (Old Kent Road), Crystal Palace, Whitwood, and Sydney (N. S. W.); and compressed air plants of a still more advanced form are working at Birmingham, Beckton and Belfast. In the latter kind of machines the charging is done by a long scoop similar to that in use on the rope-driven machines, which does not rest upon any part of the retort, and delivers a larger quantity of coals than can be done by the charger of the manual type. These long scoops necessitated a longer hopper to feed them and more power to work them; and the additional weight to be propelled overpowered the hand method in use until then, and rendered it imperative to add mechanical means.

The first two sets of rope driven machines were erected, according to the instructions of Mr. S. R. Ogden, for the Blackburn Corporation. The house is on the ground floor, with large coal stores on each side under the same roof as the retort house, but separated from the working space by columns supporting the roof. There are 34 benches of retorts, making 340 mouthpieces; and the retorts are not throughs. The mouthpieces are of the same section as the retorts, and are 20 in. by 15 in. D. One drawing machine and one charging machine on each side of the house works the whole of these retorts, with the exception of a bed at either end, which is too near the wall to allow the machines to work. The coal is delivered to four coal breakers—two on each side of the house—by carts, and the coke is drawn out of the retorts directly into barrows placed in front of the drawing machine, and between it and the retort stack. A small steam engine is placed in a room built off one corner of the coal store, and a line of shafting is fixed at right angles to the stack, with rope pulleys for driving the rope. The latter extends the whole length of the house, without any support for the bottom or driving strand, except the machines, which may be anywhere between the two ends.

Another example of the rope-driven system is that now working at the Beckton station of the Gas Light and Coke Company, where it is erected in the No. 12 retort house, in which there are 45 beds of nine through D retorts, of 20 in. by 13 in. section, or a total of 810 mouthpieces. The house is of the standard Beckton type, with stage floor and generator furnaces. The coal stores are at either side, and are separated from the house by the roof columns only; the coal being brought in by an overhead railway on each side, and the coke falling from the retorts to the basement, from which it is removed in railway trucks. There are six charging and six drawing machines provided, two of each being kept as duplicates and in reserve in case of fogs, or any other exceptional demand for gas requiring 4-hour charges to be put in to meet it. The engines for driving the ropes are fixed at one end of the retort house, under the stokers' lobby; and two are provided—one being always out of action. Between the engines, and on the same centers as the respective crank shafts, there lies a length of shafting with clutches at each end, by which either engine can be coupled up to the work. On this length of shafting are fixed the six pulleys for driving six sets of overhead countershafting by belts. Each set of countershafts, of which there are three on each side of the stack, drives the rope which communicates power to one pair of machines, and stretches the whole length of the house, with two or more intermediate supports, according to the position of the various machines. Each pair of machines—one drawing and one charging machine forming a pair—is kept quite separate and distinct from the remainder of the plant; and any pair can be left out of action or put into action at will. Either pair can work in any position on the one side of the house, and draw any of the retorts. The coal is dealt with by four coal breakers (with elevators and hoppers) on each side of the house; and when loaded from the ship into wagons on the pier, it needs no further handling until the coke is shovelled into the trucks which remove it from the basement of the retort house. The loaded coal trucks pass over the coal breakers in the coal store, and deposit the coal on the breaker. It is then elevated into the storage hoppers, passes from there into the charging machine, and is delivered into the retort. When it is carbonized, the coke is drawn out, and falls into the basement direct—no handling whatever being required.

Three of the most recent examples of this class of machinery are those in operation at the South Metropolitan Gas Works at East Greenwich, at the Melbourne Gas Works, and at the Aberdeen Corporation Gas Works—the latter in a retort house 369 ft. long, containing 16 double settings of eight D retorts, with regenerator furnaces, as also about 12 double settings with ordinary furnaces. The Aberdeen machinery is practically a reproduction of that in operation at Blackburn and Beck-

ton, with the exception of the coal breakers. These we had to make specially large and strong to deal with the great and exceedingly tough lumps of the hardest Scotch cannel. Upon trial of the first of them, we found we had arranged to break the coal in rather smaller pieces than Mr. Smith desired; so we had to alter the pitch of the claws in the whole of them—a circumstance which delayed the completion a little beyond the specified time. From a return Mr. Smith gives me of his working, I understand he is making a very substantial saving over his previous system of hand labor, although the machinery is only in partial operation; and I am in hopes of his favoring the members with a little of his experience.

I wish, however, to point out that the drawing and charging machines are made exceptionally strong—stronger than our earlier machines; for experience has taught us that, for retort house work, where everything has to be kept going night and day, the ordinary engineers' rules are not adequate to the requirements, and it has been found necessary, in order to avoid any risk of mishaps or breakdowns, to make a large number of the parts of cast and Bessemer steel, and the bearings very long, and, in most cases, of gun metal. This, of course, makes the machinery more expensive in first cost, but reduces the wear and tear to a minimum.

There are one or two points of vital importance in the designing of retort houses for machinery. In the first place, let me impress upon you the necessity of having mouthpieces of the same section throughout as your retort; in fact, an increase of the section by ¼ inch all round would be a great advantage. If the mouthpieces are at all contracted, the coke often jams hard in them; and if the drawing machine is powerful enough to overcome the obstruction, and draw the coke out at one stroke, it throws a great strain on the mouthpiece bolts, and through them on the whole face of the setting. Therefore, in designing my drawing machines, I have arranged that the power at disposal for drawing out the coke shall not be greatly in excess of that required under normal conditions. At one or two works—notably at Beckton and Birmingham—I have had to draw and charge by machinery retorts with contracted mouthpieces; and the experience I have had makes me speak strongly on this point. Again, the differences in section of retorts at different works, and very often at the same works and in the same house, are a great drawback to working machines economically. All the retorts in a house should be of the same section; and every retort in a tier shou'd be at the same height from the floor. When these details are carried out, you get the best results; and by adopting, when making renewals, a section of retort to which either manual or power machinery could be equally well applied, the introduction of machinery in the future would not be accompanied by any additional expense beyond that incurred in purchasing it.

From large experience in the working of all kinds of settings, I am fully convinced that the best sizes of retorts for small and medium sized works are those recommended by me when my manual machines were first introduced—viz., 21 in. by 15 in., 21 in. by 15½ in., 22 in. by 15 in., 22 in. by 16 in., ⏛ shape. These sizes will be equally suitable for working either with or without machinery. In larger works, where power machines can be economically employed, a somewhat larger variation can be allowed for. Any section of retort can be charged by the power machines, but the sizes most suitable are: 21 in. by 15 in. oval; and 20 in. by 15 in., 21 in. by 15 in., 22 in. by 15 in., and 22 in. by 16 in., ⏛ shape.

The retort mouthpiece lids require special attention, as they must be arranged to close back to allow the machines to pass. The distance from the face of the retort stack to the machines is 2 ft. 6 in.; and the lids and fittings will be required to fully clear this, both when they are open and when they are closed. Again, the hinges should be made so that the lids are closed in the same direction as the machines travel when at work.

The next point to be considered is the space for the machinery to work in. Supposing a retort house was being designed for machine stoking, I should recommend, for 20-ft. through retorts, that there should be a space of at least 21 ft. 6 in. between the retort stack and the wall or the face of the roof columns. For power machines at each end of the house, there should be a space of 18 ft. from the vertical center of the end retort to the face of the end wall of the retort house, to admit of the whole of the retorts being drawn and charged. For manual machines the space between the vertical center of the end retort and the face of the end wall of the retort house should be 11 ft. 9 in. The height of the the roof should be sufficient to clear the top of the elevators. The height of the floor line to the top of the elevators, measured at a distance of 11 ft. from the face of the retort stack, is 32 ft., at which height all roof principals and tie-rods should be clear. This dimension is supposing the retorts are arranged in three tiers. If for four or five tiers of retorts, for which the machines are sometimes arranged, the height of the elevator must be increased proportionately according to the height of the top retort from the ground line. The most economical method of designing a retort house of small size, to be worked by a minimum number of men and machines, is to have single retorts—say 10 ft. long—so that only one coal breaker and elevator and one set of machines would be necessary. A good example of the application of machinery to small gas works is that designed by Mr. W. A. Valon for the Westgate and Birchington Gas Company, where the annual make of gas is about 18 millions. If the rope system of driving the machines is adopted, I advise the driving engine to be fixed at one end of the retort house, and preferably in a line with the retort stack. This engine should be in a building outside the retort house, if convenient; but the system of rope transmission is such that the engine may be fixed in any other convenient position. At the end of the retort house farthest from the engine there should be room for the rope tension gear, which is fixed beyond the end of the retort house for a distance of 10 ft.

Although I have given you these dimensions as applying to the best house for machine stoking, it is by no means impossible to apply machines to retort houses where the working spaces available are much less than those named. A number of instances can be pointed out where they are working 20 ft. retorts with a space of less than 20 ft. between the stack and the wall; and if the retorts are of less length the space required can be reduced in proportion. Sometimes where space at the end of the retort house is unavailable, the machines are run out of the house at the ends. With regard to the height of the elevators, these have often to be arranged to go between two roof principals, and occasionally through the roof itself; or other modifications have to be made to suit the circumstances.

With the view of endeavoring to meet your wishes, I have recently obtained working results, giving the cost of labor and wear and tear, from a number of engineers at works where either my manual or power machinery has been in operation several years. In some instances, where the hand and machine systems are in joint operation, I cannot get complete returns, because of the difficulty of separating the gas produced under the two systems, and the trouble of keeping separate records of weights of coal. But in these cases they inform me that they will be pleased to speak most highly of the machinery, and will be glad to give any information in their power. I think, however, that the many facts laid before you from a large number of engineers, with whom most of you are personally acquainted, testifying to the excellent results obtained by the adoption of the system, prove conclusively that the time has arrived when, if you wish to be in the first rank of progress, it will be necessary for you to adopt these labor saving appliances.

The author then gave some recent returns he had received from a few gas works where his manual machinery is in operation. Summarizing the particulars furnished, he stated the relative difference in cost between hand labor and manual machinery to be as follows:

	Machinery, per Ton. s. d.	Hand Labor, per Ton. s. d.	Saving by Machinery, per Ton. s. d.
Maidstone—			
Total cost of carbonization.....	1 5.75		
Add interest, wear and tear, etc.....	1.50		
	1 6.25	2 9	1 2.75
Tunbridge Wells—			
Total cost of carbonization.....	1 6.97		
Add interest, wear and tear, etc.....	1.50		
	1 8.47	2 9	1 0.53
Ramsgate—			
Total cost of carbonization.....	1 6.40		
Add interest, wear and tear, etc.....	1.50		
	1 7.90	2 9	1 1.10
Westgate—			
Total cost of carbonization.....	2 1.00		
Add interest, wear and tear, etc.....	1.50		
	2 2.50	3 3	1 0.50
Folkstone—			
Total cost of carbonization.....	1 8.19		
Add interest, wear and tear, etc.....	1.50		
	1 9.69	3 0	1 2.31

Referring to these figures, Mr. West said: I wish to call your special attention to the wear and tear account at the above works, which only averages 0.64d per ton of coal carbonized by manual machinery, and certainly not more than would take place upon the whole system. With

power machinery the wear and tear has been somewhat greater, especially where the retorts and mouthpieces were not of a suitable section for machine work. Where retorts are arranged under our directions or put up suitable for machine work, we are prepared to keep the machinery in repair for 5 per cent. per annum on the total outlay of machinery.

I also give you a quotation to be found in Mr. May's (Richmond) presidential address, in February, 1890, to the Southern District Association of Gas Engineers and Managers:

"May we not, in our own domain of gas manufacture, look forward to the increasing use of machinery, and to its more rapid perfection, in the immediate future? Even at the present time it seems strange how comparatively few works have adopted the facilities for mechanical stoking which are in existence. At Richmond, West's manual power machinery has been employed for some years with excellent results. The wages for carbonizing, including all charges from the coal store to the coke yard, are about 1.80d. per 1,000 cubic feet; the interest and wear and tear of machinery come to 0.17d.; making a total of 1.97d. per 1,000 cubic feet. This, so far as I have been able to learn, shows a saving of 10d. per ton of coal carbonized as compared with hand labor. The increased make, through more expeditious working and even distribution of the charges, is well worthy of consideration; the sale of 16-candle gas per ton of half Newcastle and half Yorkshire coal at Richmond during the past two years averaging 10,300 cubic feet."

Most of the above machines work off five charges in 24 hours—the charges varying from 300 to 336 lbs. per charge; so that the make per retort is very high, and hence a considerable saving in plant. Since these figures were given I believe stokers' wages have increased in the southern district; but the same relative advantages will exist between hand and machine work.

The author next gave some returns as to the working of his compressed air and rope power machinery; the relative difference in cost between hand labor and the machinery being as follows:

	Machinery, per Ton. s. d.	Hand Labor, per Ton. s. d.	Saving by Machinery, per Ton. s. d.
Whitwood (compressed air machinery)—			
Total cost of carbonization.....	1 1.90		
Add interest, wear and tear, etc.....	2.50		
	1 4.40	2 9	1 4.60
South Met.—East Greenwich (rope power machinery)—			
Total cost of carbonization.....	1 1.14		
Add interest, wear and tear, etc.....	3.00		
	1 4.14	2 5	1 0.86
Aberdeen (rope power machinery)—			
Total cost of carbonization.....	1 6.44		
Add interest, wear and tear, etc	2.50		
	1 8.94	2 7	*10.06

*These figures show a very substantial reduction for the small number of retorts (96) worked upon; and when in full operation there will certainly be a greater saving in these works than was originally estimated for.

Coke Breaking, Elevating, and Conveying Machinery.

As previously stated, I believe I was the first to see the necessity of applying coal breaking, elevating, and conveying machinery, both in connection with stoking machinery, and also for breaking and conveying only; and the first example I carried out was for the Folkstone Gas Company in the year 1881, under the direction of Thomas Hawksley, Esq., the Consulting Engineer. The coal at these works was delivered at one side only of the retort house, which caused a very considerable amount of wheeling to the far end of the other side of the house. This, however, was overcome by carrying a conveyor across above the retort stack. I saw this machinery last week, and found it in very good order.

Referring to the drawings I have here, one shows an arrangement which we carried out about six years ago at Belfast, and which does its work very satisfactorily. It was for the special purpose of elevating and conveying the coal from a store in a corner of the works, a long distance from the retort house, both for supplying coal to my stoking machinery and for delivering coal from the hoppers into wagons for serving other portions of the works in the case of a stoppage in the coal supply. The saving in this case was very considerable, besides dispensing with the difficulty of having the men on the ground floor wheeling the coals in a portion of the yard which was already confined for space for the ordinary operations that were going on. Another is an example of the Cheltenham Gas Works, where the stores are some distance from the retort house, a road running between them. Very considerable saving in labor is made by the arrangement of these works. Then there is another example at the Whitwood Chemical Works. Another drawing shows two long elevators and conveyors at the Sheffield Gas Works, running from the railway sidings, over the yard, through a wide coke shed, and across the retort benches, delivering the coal direct into hoppers in connection with my power drawing and charging machinery. We have also many other examples of a similar character, as will be seen from the numerous drawings before you.

One of the latest and most perfect examples of this particular branch of breaking, elevating, conveying and storing coal ready for use, is that which I erected at the Higginshaw works of the Oldham Corporation last year, the drawings of which are on the walls; this being absolutely the first example of the complete application of machinery driven by one engine for the purposes intended. The coal store at the works is 220 feet long by 60 feet wide; and the railway runs along one end only. There used to be turn-tables opposite the doors of each coal store, and from these turn-tables the railway trucks were drawn into the stores by a horse—very considerable expense being incurred in unloading and stacking the coal. Before the introduction of the machinery, from 12 to 20 men and one horse were required, according to the season; whereas three men now do the whole of the work, including the keeping up of steam in the boiler and the unloading of the wagons.

The different operations may be briefly stated as follows: The coal wagons are run over a large hopper capable of holding 10 tons, and are hoisted up at one end by an overhead crab and gearing, driven from the engine shafting, until all the coal runs out. At the bottom of this hopper is one of West's patent coal breakers with combined engine, supplied with steam from a stationary boiler; and this breaks all the large lumps, letting the smaller coal pass through. As it does so it falls into a pit immediately beneath the breaker, in which the lower end of an elevator works, the elevator being driven from the engine shafting. This elevates the coal through an opening in the end wall of the stores, and delivers it on to a conveyor band extending the whole length of the stores, and driven from the same shafting as the elevator. In order to deposit the coal where required in the store, a throw-off carriage is provided which can be moved to any position.

The average of a number of tests with different kinds of cannel and coal, as to the breaking, elevating, and conveying capabilities of the apparatus, is about 38 tons per hour; or if Newcastle coal were alone used, each set of apparatus would deliver into the stores 50 tons per hour, or about 2,000 tons per 24 hours.

The original cost by hand labor and the present cost by machinery are as follows: *Hand Labor.*—Wages and fodder, 4d. per ton. *Machinery.*—Wages, wear and tear, interest, fuel, oil, and waste, 1.77d. per ton.

Other drawings here show the coal breaking and elevating arrangements in connection with inclined retorts at Rochdale, Birkenhead, and Burnley. We are now carrying out a large order for the Birmingham Corporation, at the Windsor street works, for breaking, elevating, and conveying coals into a continuous hopper. It may also be interesting for you to know that we have received additional orders for stoking machinery worked by compressed air for the Saltley works of the Birmingham Corporation.

A very great saving can also be made in the handling of coke by machinery; and I have done a considerable amount of this class of work. There is a good example of coke stacking at Belfast, where the coke is handled by hydraulic cranes; and I learn that Mr. Hack, of Birmingham, is about to erect machinery upon a large scale for this purpose, and I have no doubt that he will soon see the advantages arising therefrom.

Inclined Retorts and the Cost of Working.

In recent times, another system of stoking has been prominently brought before gas engineers and the general public; and it therefore becomes advisable to make a comparison, not only between stoking by hand and by machinery with horizontal retorts, but also between the working of machinery with these and the new system of inclined retorts aided by machinery as well. There are several modifications of the inclined retort system, commencing with that of M. Coze, and including those of Messrs. Morris and Van Vestraut, using coal breakers, elevators, trucks, and shoots only, and that of Mr. Trewby, where a patent charging plate is employed in addition to the breakers and elevators.

Several gentlemen have been comparing the inclined retort system against hand labor with horizontal retorts; but their figures only represent a fragment of the cost of the retort house work. Other gentlemen

have been comparing the system against both hand labor and machinery; and in endeavoring to do this, they have shown clearly that they are not well versed in the subject of machine stoking. Before making any comparison myself as to the cost of working these various systems from the figures which have been presented to us from several sources, I feel bound to criticize the system itself; and in doing this I shall give my opinion based on absolute facts obtained from practical results and observations in connection with the carbonization of coal.

I shall first refer you to the results of my early experiments with the setting of short retorts with mouthpieces at each end. With these settings, as previously explained, the mechanical arrangements were most satisfactory; but I was reluctantly compelled to abandon the scheme, because I could not get the same results off the same space (although the fuel account was much increased) as I was then obtaining from the old system of working. Yet with the very same retorts, after the mouthpieces at one end were taken off and the retort stopped up with 14 in. of brickwork, good results were realized. These facts, gentlemen, point to the great loss of heat which took place by radiation from the retort mouthpiece and ironwork, and the effect produced on the gas inside the retort. There is no doubt whatever that the hot gases coming in contact with the mouthpieces at the end, caused a condensation of the gases, and that a quantity of the light-giving hydrocarbons were deposited in this mouthpiece and the end of the retort to which it was attached. The gas then (after being cooled) had to travel back over the hot coke to the ascension pipe, with further injurious effect.

Now, gentlemen, I will ask you to look at the retort with which I was experimenting, and I will put this question to you: What is the difference between this and the inclined retort? Is not the only material difference the inclined position? Therefore, is not this system liable to one and all of the disadvantages attendant upon mine?—in fact, I should assume in a greater degree, because their gas has to travel downhill before it gets to the ascension pipe. M. Coze, however, appears to have discovered from his experiments that there was a considerable loss in radiation from his shoots; for, on the authority of Mr. Van Vestraut, it has been found necessary for these iron shoots to be surrounded by brickwork. Yet in his own system he has ignored the necessity. He also points out that it is essential to this system, in order to burn off the charges, to adopt gaseous firing to ensure the equal heating of the retorts. For my own part, I am satisfied that retorts upon the inclined system could not be heated in the ordinary way of firing, and that it is absolutely necessary for them to have a large excess of heat to make anything like a return in the quantity of gas produced, which means a very extravagant waste of fuel.

It must not be forgotten that my old friend, Mr. Carpenter, of Sheerness, with whom I have been intimately connected for many years, spent a very considerable amount of time and money in trying to work out a system of inclined retorts (and I cannot see any material difference between his arrangement and that which has been recently brought to notice); and he found that, with the most careful manipulation in putting the coal into the retorts, he could not always secure very regular distribution, and that the tar deposited in the mouthpieces, and its liability to get mixed with the coke, were defects which would require to be surmounted.

I believe I have carefully read the whole of the literature which has been volunteered in reference to this system, besides having had the opportunity of seeing it in operation at various works; but, up to the present time, I have not heard of any complete experiments being made anywhere giving (1) the make of gas per ton of coal carbonized, (2) the illuminating power of the gas, (3) the fuel used, and (4) the total cost of carbonizing wages. I beg to submit that these are facts you ought to know before you can judge of the merits of the scheme; and until these particulars and the total cost of the installation of the system are ascertained, I cannot see how you can satisfactorily compare it, either against the old system of working, or against the statements which I have laid before you showing the cost of the working of machinery upon the horizontal system. I therefore venture to suggest to you that if ever there was a system that your "Committee of Investigation" should go fully into, it is this one. I do think, and I have advised, that in large undertakings a few trial settings should be erected as an experiment; and these should be thoroughly tested in every respect in the way I have indicated.

With long retorts, like those Mr. Hunt, of Birmingham, is erecting, the question of radiation may be partially overcome; in which case the question will resolve itself in large works into the relative advantages of working each system, taking the weight of coal and volume of gas produced, and all charges, from the taking of the coal from the stores to the delivery of the coke into the yard.

There appears to be very considerable doubt as to the angle at which the retorts should be erected; and various angles are suggested. The difficulty appears to me to be insurmountable when you have a large variety of coal and cannel to deal with; and it seems that it will be found necessary to have some mechanical appliance to ensure success. Of course, my own opinion is that the *right* angle from the face of the stack will still be found to be the best angle.

As to the much talked of benefit or comfort the workman can derive from the working of the system, I have failed to discover that he very much appreciates working on the top of the retort benches or between them, where he is subjected to the smoke, sulphur fumes, and intense heat from the retort settings that surround him, and which in some cases is even as high as 200° F. Those of you who have not seen these men at work in these positions, ought to do so, without which you cannot fully appreciate my remarks.

It may be said that I am somewhat prejudiced on the subject. There is no reason why I should be so, as I have been favored with a fair number of orders for breaking, elevating, and conveying machinery in connection with this inclined retort system; and I believe I have the sense to know that no words of mine will prevent the "survival of the fittest." What I strongly recommend to you, as practical engineers in charge of important undertakings, is to thoroughly test and weigh in the balance the various schemes, and adopt that which is best.

I am very gratified, after so many years of persistent working in connection with stoking machinery, to find that I do not have to rebut the criticisms and meet difficulties that I had to contend with in former days. In some cases during the good old times, when there was no competition, some managers were, I think, too much inclined to "rest and be thankful." One friend of mine indicated that he liked me and also my machinery very well, but he did not see what advantage it would be to him, as he was paying his maximum dividend, and still had a large balance to spare. I, of course, suggested that he should reduce the price of gas to the consumers. But he remarked that the public were not very grateful for what you gave them. While believing you must not expect many thanks from the public, I do hold strongly that all gas companies and corporations having the charge of a regulated monopoly have very strong obligations towards the public; and, while securing a return for their investments, they should use the best known means in their power to reduce the price of gas to the public. This feeling now seems to prevail universally amongst engineers. There appears, however, a desire in some quarters (it may possibly be for political or other motives) to keep the public from having cheap gas, by trying to prevent the introduction of all modern labor saving appliances. To all such I would say that they will not be able to obliterate the word "Excelsior."

Advances in Electric Heating.

Mr. W. R. B. Willcox, writing in the *Electrical Engineer*, claims that the practicability of electrical heating has recently been receiving its conclusive demonstration. The time has come when apartments, wherever situated, on land or sea, moving or stationary, may be warmed by electricity. The uses to which electrical heaters may be put are far more numerous than those persons not interested in that particular branch of the electrical industry appreciate. The wide range of their usefulness comes home, perhaps, more forcibly to those engaged in the work of their commercial distribution. Hints, propositions, happy suggestions, incidentally remarked, bring forth delightful pictures of comfort, which, like good architects' sketches of some proposed edifice, are accurate representations of what is to be.

The thought that all the useful effects of combustion, as employed for the comfort of man, may by a slender wire be brought into our homes, thereby doing away with the customary periodical transportation of fuel, while at the same time all the disagreeable and even dangerous products of combustion, such as smoke, gas and flame, are carried away 100 ft. above our heads by the tall chimneys of some power house, itself, perhaps, many miles distant, has no inconsiderable charm.

In any electrically heated house, the absence of clumsy heat and smoke conveying apparatus is noticeable, and in May, the month of universal house cleaning, it would be still more noticeable, for no soot can be shaken from a No. 16 copper wire. In warm weather the electric heaters take the place of gas and oil burners for doing small cooking. Without the disagreeable dirt and odor of the latter, they perform within a few minutes such services as boiling an egg, warming a cup of tea or coffee, toasting crackers or bread. Put to this use upon train or shipboard, the results are especially pleasant. While at all times abundant warmth may be obtained from electrical heaters, they furnish,

when desired, less warmth than those in present use. Thus upon cool spring and autumn evenings, when it is not cold enough for a fire in a furnace or stove, yet is disagreeably chilly, they render a delightful service. There is no arranging of fuel, regulating of draughts or removing of ashes. Within a few minutes after the simple act of turning a switch is performed the chill disappears from the air. The heaters occupy but little space and may be formed into more shapes than stoves and other heating appliances at the present time.

What the incandescent lamp is to artificial lighting, the electrical heater is to artificial heating. As are the lamps, so will the heaters be distributed over the walls of our theatres and concert halls, shedding their warmth uniformly throughout the room as the former do their light, forming, it may be, the panels in some elaborate wainscoting or included in some ornamentation; they may not only provide warmth for our bodies, but also be the cause for the removal of the cumbersome, inartistic radiators, registers and steam pipes, which are for ever obtruding themselves upon our vision. In general use, their safety, neatness and labor saving qualities recommend them to all who have at hand the electric current or convenient means for generating the same. It is not unreasonable to predict that by the time the idea of electric heating is as old as that of electric lighting or of electric traction, power stations for that particular purpose will also be erected.

While in such stations where the power is derived from steam engines, the expense of the heaters connected therewith may be somewhat in excess of that of coal, oil or gas heaters, still that excess is no more than a just price for the increased convenience and comfort received therefrom. But in many places water power is utilized for dynamo work. In such localities people easily recognized the economy of heating by electricity, and especially is this so when in those same districts the cost of fuel is great. Thus the Canadians, with whom the price of coal is high, while swift running streams provide abundant mechanical power, are anticipating with enthusiasm the installation of power stations for supplying the adjoining territory with current solely for heating purposes.

Nearly all ocean steamships now are equipped with apparatus for electric lighting. Within a few years their dynamo capacity will be increased so that they may provide heat as well as light. One system of wiring will then perform the combined work of conveying light and heat and the necessity for the present expensive and difficult system of steam conductors will no longer exist.

There is, however, a more urgent necessity for electrical heaters in the railway world. Electric roads, such as traverse the streets of our cities, are beginning to utilize the means so convenient for them of heating their cars. With them, not only the actual cost of heating is reduced, but the incidental expense of caring for stoves and fuel on the cars is entirely removed. The greatest boon, however, will accrue by their use upon steam roads. Already there are roads taking active measures to place them upon their trains. A prominent representative of America's leading trunk line remarked a few days since that stoves and steam for heating purposes must give place to electricity, if the latter proved at all practicable. Railroad men realize that accidents are in some cases unavoidable; that their evil, at best, is great; but it will be appreciably lessened when the danger of death by burning or scalding is removed. The time is not remote, we believe, when a dynamo car will be as necessary an appendage to a train as the tender. It will contain one or more electric generators with accompanying steam plant. In fact, it will be a power station complete in every respect, having its own separate attendant.

Thus does the electrical heater bring to us increased convenience and comfort, cleanliness and safety. And it is not by great expenditure that this improved condition of affairs may only be secured. A foreign journal of recent issue contains the remark that the one obstacle in the way of the early introduction of electrical heaters into everyday use is their excessive expense. No greater obstacle can present itself than the reiteration of such erroneous statements. Both by repeated experiments and by actual service their economy has been proven. Of novelties people are suspicious. Unless complete success attend their first appearance they wrongfully are considered failures. However, the electrical heater, like all meritorious inventions, will survive such thoughtless suspicions, and even now includes itself among our economical modern improvements.

Mastics or Metallic Cements.

Mr. C. Powell Karr explains that mastic is a substance which is generally considered to be a composition of finely ground oolitic limestone mixed with sand and litharge, and to which has been added a portion of linseed oil. Its composition, however, is quite variable; it has also received the appellation of a metallic cement. In small quantities its usage is similar to that of common mortar, in pointing up the joints of stonework and in patching up disintegrated walls. Many of these mastics contain a certain proportion of metal, iron, zinc, lead, etc., whence their name.

In general they acquire a substantial hardness after a lapse of some time. The formulæ for the preparation of these cements are exceedingly numerous, and have been more thoroughly developed and studied in Europe than in America.

At Paris alone more than 20 firms make a specialty in dealing in this building material. Most of those mentioned here are of French origin.

Mastic of Litharge.—Mix 93 parts of potters' clay, well burned and pulverized, and 7 parts of litharge, in powder, with pure linseed oil to a consistency of a stiff plaster. Sprinkle with water the surface to be coated before employing the mastic, as would be done for plastering. This mastic, as pointed out by Thenard, serves successfully to line reservoirs and point up the joints of masonry. It becomes very hard.

The following is also vouched for as being equally adapted to the same kind of work:

Siliceous sand....	14 per cent. by volume.
Pulverized chalk..	14 " "
Powdered litharge	$\frac{1}{14}$ of the weight of sand and stone together.
Linseed oil.....	$\frac{1}{7}$ of the total weight.

It is necessary to calcine the calcareous matter and sand before mixing them with the rest of the ingredients. The parts to be coated with mastic are previously painted with linseed oil.

Other compositions commended by Mr. Marcel Daly are as follows:

Cement, by weight	63.15	per cent.
White lead, by weight.....	10.52	"
Litharge, "	10.52	"
Linseed oil, "	10.52	"
Drying oil, "	5.26	"

And another is—

Pulverized burnt clay, by weight.....	50	per cent.
Litharge, "	$8\frac{1}{2}$	"
White lead, "	$8\frac{1}{2}$	"
Linseed oil for the dilution, "	25	"
Drying oil, "	$8\frac{1}{2}$	"

The last mastic is called the mastic of Corbel. It is employed for repointing the flags in humid places, to repair curb stones or the joints of dressed stone masonry which are to be painted with oil and exposed to the action of sea air. Argillaceous pozzuolana ground to a powder can be substituted for the burnt clay and white lead. This last ingredient does not appear to be of any special importance. The surfaces to which the cement is applied must be clean and dry.

Fontenelle Mastic.—Two parts, by weight, of oxide of zinc, two parts of very hard calcareous stone passed through a sieve of $\frac{6}{100}$ of an inch, and one part of crushed sandstone or quartz rock. The whole is mixed as it is served, and colored with a little ocher or carbon black, of which the weight should be be deducted from the quantity of stone employed. Then dissolve clippings of zinc freshly cut in commercial hydrochloric acid up to the point of saturation. Then add to the liquor thus prepared one-sixth of its weight of zinc dissolved. This is allowed to settle and the supernatant liquid decanted.

Then add two-fifths of water, by volume, to the liquid thus prepared. We have, as a result, a liquid and a powder which united make the cement. It is to be applied quickly to the stone surface, pricked or lightly roughened and brushed. It takes about one pound of the powder to one-third of a quart of the liquid. At the last moment the stone is moistened with the pure liquid, the cement is then applied and set with a trowel. The operation is performed in about 20 minutes. When the part to be mended measures more than 2 inches in thickness, it is found to be economical and yet not detrimental to good work to convert the cement into a concrete by adding pebbles; the pebbled surface may be afterward bush-hammered to a uniform surface.

The Cement Fontenelle, so called from its inventor, has been improved by M. Warest, of Paris, Superintendent of Bridges and Highways, who has given to it the definite composition cited above. It is resistant and inexpensive.

On a large scale it has been employed in various undertakings, notably on the Pont Neuf, at Paris, where the cornice is made of it. The results obtained are satisfactory.

Mastics for Water Jars or Vessels.—This is generally composed of iron filings, 88.8 per cent., and salt, 11.2 per cent.

Make an infusion for 24 hours in 2 quarts of vinegar; to this there is sometimes added one half quart of urine (or replace this by ammonia

water) and garlic (4 garlics). The filings should be fresh and clean, and without rust.

The hardness that this mastic acquires with time is incontestable, but it will answer only for coarse work. It is used to restore parts broken out by frost or accidents, but to blend patching with old masonry the following mixture is better:

Filings Mastic.—Take three-sevenths, by weight, of pulverized stone (as much as possible like the stone that is to be repaired, both as to color and characteristics), two-sevenths of the cement to be added slowly, two-sevenths of the cast iron filings, or the same amount of copper. It goes without saying that the iron filings is the most economical.

Triturate these three substances with care so as to arrive at a complete mixture, then moisten with water, little by little, after the manner of mixing fine plaster.

"This last cement," says M. Daly, "has given excellent results at the Hotel de Ville, of Quesnoy (North), where MM. F. Guillemin and L. Laubser have employed it with success."

There exist also many other formulæ, as said before, for obtaining a mastic or a metallic cement, Cement Sorel, Cement of Zinc-Spence, etc.

It is not sufficient that the cement, or the mastic, whatever it may be, should be good by itself, that is, economical, easy to employ, and resistant. It is necessary also that it adheres well to the stone. The precautions to be taken are to see that the surface be scraped, brushed, washed with water or oil, according to the treatment to be pursued.

Sometimes the stone to be treated is thoroughly disintegrated and patching becomes difficult. Where the disintegration has pierced to some depth, the reparation becomes almost impossible. When not too far gone, the rotten surface is superficially hardened by sizing the surface by the Faure-Kessler process. Excellent results have lately been obtained in this direction, when its operation is to restore the cornice and balustrade of some public edifice, originally executed in some friable stone of inferior quality, particularly in stone work where exposure to frost and weather have wrought the damage.

The most important binding materials in mastic cements seem to be oil and litharge. In many cities where inferior brick work is coated with mastic and forming a veneering of artificial stone, the cupidity of the contractor almost always shows in the excessive proportions of sand to the cementing material. If not properly mixed, or if properly mixed and improperly applied, the result is disintegration. If not properly mixed, although well put on, the disintegration begins in spots irregularly spaced, and the surface presents an appearance of crumbling here and there, or as if it had been punctured by tiny drills. If well mixed, but improperly applied, the veneering indicates the bad work by flaking off in spots. The latter phase of flaking is sometimes caused by using an excess of oil in coating the brick work.

[Concluded from page 223.]

Boiler Deposits.

By Professor Vivian B. Lewes, F.C.S.

The next point I attempted to determine was the effect which these oily deposits had in allowing excessive heating of the plates to take place, and retarding the heating of the water. A clean iron vessel was taken, and a known volume of water placed in it, and heated by a carefully regulated Bunsen flame, the water being raised to the boiling point in 10 minutes. This experiment was repeated a second time with the same result, and the vessel was then lined with a coating of deposit found in the bottom of the boilers which had collapsed, and rendered binding by admixture with a small trace more valvoline. This coating was laid on $\frac{1}{16}$ of an inch in thickness, and the former experiment repeated, the same flame being used and the same volume of water taken, with the result that it took 15 minutes before the boiling point was reached, showing that, even if no damage resulted to the plates from overheating, such a deposit would cause a large increase in the fuel used.

In attempting to ascertain to what extent extra heating of the plate took place from this cause, I employed a series of substances of known igniting and melting point, raised the water in the various vessels to the boiling point, and then brought the clean bottom of the vessel in quick contact with the test substance, and took the results as indicating the temperature of the exterior of the plates.

Clean vessel...	Sulphur did not melt.....	below 115° C. = 239° F.
Coated vessel..	Sulphur melted, but did not inflame	above 115° C. = 239° F. below 250° C. = 482° F.
	Gun cotton ignited.....	above 200° C. = 392° F.

So that the $\frac{1}{16}$ of deposit caused, with slow heat, a rise in temperature of the plate from under 115° C., or 239° F., to over 200° C., or 392° F. It is manifest, however, that the fiercer the heat the more marked will this overheating become, and in the next series of experiments the Bunsen flame was replaced by an atmospheric blowpipe, and the temperature attained tested as before.

Clean vessel.....	Sulphur did not melt.....	below	115° C. = 239° F.
Coated vessel.....	Gun cotton ignites.....	above	200° C. = 392° F.
	Tin melts.....	"	228° C. = 444.4° F.
	Sulphur ignites.....	"	250° C. = 482° F.
	Lead melts.....	"	334° C. = 633° F.
	Zinc melts (just)	"	423° C. = 793.4° F.

Whilst, on replacing the atmospheric burner by an oxy-coal gas flame, I found no difficulty in fusing a hole in the bottom of the vessel, which was made of thin wrought iron plate, showing that a temperature of 1,500° C. = 2,732° F. had been attained, and it is therefore manifest that, with the fierce heat existing in the boiler furnaces, given an oily deposit only $\frac{1}{16}$ of an inch in thickness, the plates will readily be heated to a temperature at which they are totally unable to withstand a pressure of 80 lbs. of steam, and collapse of the furnace crowns must follow.

The great points to be sought in a good lubricating oil are that it shall be a pure mineral oil, and that its boiling point shall be well above any temperature likely to be attained in the cylinder. Oils satisfying these requirements can readily be obtained, but users of lubricants must remember that, in order to obtain them free from any constituents of dangerously low boiling point, expensive processes have to be resorted to, which must of necessity increase the price of the oil, and that it is useless to expect to obtain a really good lubricant at a low figure.

The great advantages of a good mineral oil cannot be too strongly insisted on, and any lubricant containing animal or vegetable oils to give it body should be unhesitatingly discarded. The mineral oils are not fats, but hydrocarbons—compounds of carbon and hydrogen—and the portions used for lubricants are those left after the more volatile constituents have been distilled off, and they differ widely from animal and vegetable oils, which contain so-called fatty acids, which are liberated from them by the action of superheated steam, and these acids attack iron, copper, and copper alloys with the greatest readiness, forming metallic soaps, which are compounds of the fatty acids with the oxides of the metals, and so cause serious damage to both boilers and fittings. The animal and vegetable oils, in contact with air, especially when heated, take up oxygen, and become gummy and resinous, and gradually so stiff that frequent cleaning becomes necessary, a trouble entirely avoided with mineral oils.

In dealing with the prevention of such deposits, it seems to me that the most feasible plan is to pass the feed water through a long tube filled with clean coke in pieces the size of walnuts, which would act as a scrubber, and would free the greasy water from the traces of oil, and prevent their going forward to the boiler. I have already pointed out that the collapse of furnaces from the presence of oily deposits almost invariably takes place in boilers fed with fresh water, and that oil, when it goes into the boiler, floats, because it is specifically lighter than water, until solid particles of calcium compounds coming in contact with it and imbedding themselves in it so increase its weight, that, reaching the same density as the water, it commences to circulate with the convection currents in the water, and is so drawn down, and attaches itself to tubes and furnace crowns, causing, eventually, damage.

In the case of a transatlantic liner using fresh water only it takes at least four days' hard steaming to bring the density up to $\frac{1}{32}$nd, whilst if sea water had been used the density would have started at this and would never, after the first few days, have been much below $\frac{2}{32}$nds, and the oil would have remained as a scum, and would never have reached the furnace crowns. In my last paper on boiler incrustations I pointed out that it was quite possible to prepare sea water in such a way as to practically prevent any serious deposits forming from it, and the same process would prevent the trouble I have now been describing to you.

In the summer of last year Mr. Biles, who is always to the front when he thinks there is a chance of improving marine engineering, kindly gave me the opportunity of trying the effect of prepared sea water upon a crane boiler at the Naval Construction Works, at Southampton, and, after a few preliminary experiments to determine the best form in which to work the "precipitator," the boiler was worked continuously for a month with water drawn from the Itchen half-an-hour before high tide, at which period analysis showed that the water was to all intents and purposes sea water, plus a fair amount of suspended mud. This, after preparation in the "precipitator," was fed into the boiler, and on opening it in the presence of Mr. Milton, Mr. W. H. Riley, R. N., Mr. Biles, Mr. Gearing, and Mr. Dusantoy, it was found perfectly clean, the surfaces looking as if they had been given the thinnest possible coat of whitewash.

The process employed was to add to the sea water a known quantity of precipitator powder, consisting chiefly of soda ash, and, having done this in a closed vessel, to heat the mixture by blowing into it waste steam, until a pressure of from 5 to 10 lbs. was created. Under these circumstances practically all the magnesium and calcium salts separate from the water and are easily got rid of by filtering it under pressure into the hot well. I had proposed in the first case to heat the liquid by blowing the steam through a coil in the precipitator, but practical experiments soon showed that the heating surface was not nearly enough, and so the waste steam was simply blown in, allowance being made in the precipitator for the water due to the condensation. I also found it aided the reaction to heat the water first just to the boiling point before adding the precipitator powder, as under these circumstances the deposit settled more quickly and threw less strain upon the filters. The precipitator was 6 ft. 4 in. high and 3 ft. in diameter, and held a ton of water, and the time taken, from the first running the sea water in to its delivery into the hot well, was 1 hour 15 minutes, so that in practice, giving plenty of time between the makes, it would be perfectly easy to prepare 8 to 12 tons in the 24 hours with a small precipitator of the size used. The prepared water has a density of $_{32}^{1}$, and may with safety be evaporated until its density is $_{32}^{5}$, the salts present not crystallising out until a density of from $_{32}^{6}$ to $_{32}^{7}$ is reached.

Professor Doremus, of the College of the City of New York, proposes to use sodic fluoride as a precipitant for the scale-forming constituents of sea water, as a smaller weight is required, and the action is more rapid and more perfect. The great objection has up to the present time been its cost, but I am informed that this has now been so far reduced as to bring it within the scope of extended commercial use; and, should it be used on a larger scale, the price could be readily brought much lower. Professor Doremus claims that the precipitation of the calcium and magnesium salts takes place with very great rapidity, that the sediment shows no tendency to cake or adhere to the sides of a hot vessel, and that it is less bulky than the precipitate formed by soda ash.

In preparing sea water in the way I have proposed every precaution must be taken to add slightly less of the precipitant than is necessary to entirely throw down the calcium and magnesium salts, as it is manifestly impossible in practice to guard against small quantities of sea water finnding their way into the boiler, either from leaky condensers or else being fed in by the engineer during some emergency, and if, under these conditions, any excess of the precipitant were present in the boiler, a bulky precipitate would be thrown down and cause trouble, although it would not bind into a solid scale.

There is no doubt that, if Professor Doremus can so reduce the price of sodic fluoride as to enable it to be used for this purpose, it would be of great use, as the fluoride undoubtedly completes its action on the salts of magnesium and calcium more rapidly and thoroughly than the soda ash, and it would be easier, therefore, to so regulate the quantity added as to remove, say, five-sixths of the injurious constituents from the sea water without allowing any precipitant to enter the boiler.

In conclusion, I will briefly recapitulate the means which seem to me best adapted for preventing the formation of the dangerous organic and oily deposits I have considered in this paper, and these are:

I. Filtration of condenser water through a coke column.

II. Free use of the scum cocks.

III. The use of water of considerable density rather than of fresh water.

IV. The use of pure mineral oil lubricants in the smallest possible quantity.

[Concluded from p. 226.]

Text of the Decision in the Case of the Edison Electric Light Company vs. The United States Electric Lighting Company.

The claims are as follows:

"1. An electric lamp for giving light by incandescence, consisting of a filament of carbon of high resistance, made as described, and secured to metallic wires as set forth.

"2. The combination of carbon filaments with a receiver made entirely of glass and conductors passing through the glass, and from which receiver the air is exhausted, for the purpose set forth.

"3. A carbon filament or strip coiled and connected to electric conductors so that only a portion of the surface of such carbon conductors shall be exposed for radiating light, as set forth.

"4. The method herein described of securing the platina contact-wires to the carbon filament, and carbonizing of the whole in a closed chamber, substantially as set forth."

The specification is addressed to those who were skilled in the art to which it relates; who appreciated the advantages of arranging incandescent lamps in a system of multiple arc, and of providing the lamp with a burner of high resistance with small radiating surface; who knew how high resistance, both specific and total, is imparted to a conductor; who knew that the rods, pencils, or other forms of carbon burners previously used had not been designed to embody the principle of high resistance; who knew how desirable it was to maintain the burner in a perfect vacuum, or in gases that would exclude the oxygen; who knew what had been attempted and had proved impracticable in that behalf; who knew that such materials as are mentioned in the specification (even the tar-putty compound seems to have been used in one process) would compose a carbon of high resistance when subjected to a proper process of carbonization; and who knew how to practice proper processes for the carbonization of such materials.

Read by those having this knowledge, the radically new discovery disclosed by the specification is that a carbon filament as attenuated before carbonization as a linen or cotton thread, or a wire seven one-thousandths of an inch in diameter and still more attenuated after carbonization, can be made which will have extremely high resistance and be absolutely stable when maintained in a practically perfect vacuum. It informs them of everything necessary to utilize this discovery and incorporate it in a practical lamp. It describes, with the assistance of the recital in the second claim, as the vacuum in which the burner is to be maintained a bulb made wholly of glass, exhausted of air, sealed at all points by the fusion of the glass, and in which platinum leading wires are sealed by the fusion of the glass. It describes the materials of which the burner is to be made, and instructs them that the materials are to be shaped into their ultimate form before carbonization. It describes the use of platinum for leading wires, and a method of securing the leading wires and filaments, intended to dispense with clamping, which consists in moulding tar-putty about the joints and carbonizing the whole in a closed chamber. Besides stating that the resistance of the burner will be greatly increased and the radiating surface still be kept within moderate limits by coiling it in the form of a spiral, the specification states that by increasing the lengths of the filament coiled the exterior only will be the principal radiating surface, and greater steadiness of illumination will be promoted.

The first claim must be read with several limitations. The filament is to be made of carbon of high resistance; that is, as the experts agree, of high specific resistance. The filament is to be made as described, that is, the materials are to be of some of the kinds described, and are to be shaped in filamentary form and then carbonized. The filament is to be secured to metallic wires according to the method of the patent, because the claim implies the elements of a globe and metallic conductor arranged in circuit with the burner, otherwise the combination would not be operative, and it would have been needless to specify the securing of the metallic wires to the filament unless it was intended to insert into the claim the specific method of doing so emphasized in the specfication.

The defendant does not infringe this claim, if for no other reason, because the leading wires in its lamps are not secured to the filament according to the method of the patent, that is, by cement carbonized in situ, by clamps such as the specification condemns.

The second claim is broad enough in its phraseology to secure the real invention described in the specification, and can be read consistently with its language so as to impart into it every essential limitation.

It was a remarkable discovery that an attenuated thread of carbon would possess all the long-sought qualities of a practical burner when maintained in a perfect vacuum. The extreme fragility of such a structure was calculated to discourage experimentation with it, and it does not detract in the least from the originality of the conception that previous patents had suggested that tin plates, or pencils, or small bridges could be used. The futility of hoping to maintain a burner in vacuo with any permanency had discouraged prior inventors, but Mr. Edison is entitled to the credit of obviating the mechanical difficulties which disheartened them, but what he did in this respect was a matter of only secondary merit, and was no longer new in the art because he had already disclosed it in his French and English patents. What he actually accomplished was to unite the characteristics of high resistance, small radiating surface, the durability in a carbon conductor by making it in a form of extreme tenuity, out of any such materials as are mentioned in the specifications, carbonizing it, and arranging it as he had previously arranged his platinum burner in an exhausted bulb made wholly of glass and sealed at all points, including those where the leading wires entered, by the fusion of the glass. He was the first to make a carbon of materials and by a process which was especially designed to impart high specific resistance to it; the first to make a carbon in the

special form for the special purpose of imparting to it high total resistance; and the first to combine such a burner with the necessary adjuncts of lamp construction to prevent its disintegration, and give it sufficiently long life. By doing those things he made a lamp which was practically operative and successful, the embryo of the best lamps now in commercial use, and but for which the subdivision of the electric light by incandescence would still be nothing but the ignis fatuus which it was proclaimed to be in 1879 by some of the learned experts who are now witnesses to belittle his achievement and show that it did not rise to the dignity of an invention.

The coiled form of the burner is only an alternative feature and is not a constituent of the second claim. It is the subject of the third claim. Nor is the bent form or any form other than the filamentary. It may be that in the haste which has always seemed to characterize Mr. Edison's effort to patent every improvement, real or imaginary, which he has made or hoped to make, he had not stopped to reflect when he framed his application for the patent that the filamentary burner would do its work just as well uncoiled as coiled, provided the same length and cross section were used. It is true that it is said in the general statement of the nature of the invention that the burner is so "coiled or arranged" as to offer high resistance and present a small radiating surface; but this description is satisfied by any arrangement, whether by coiling a considerable length in a small globe or using the same length uncoiled in a large globe, by which sufficient total resistance is obtained from a filament of small diameter. It certainly would not involve invention to omit the coiling and elongate the globe; hence, it is manifest that the invention described is the same thing essentially, whether the coiled form is used or not. The language is satisfied if the burner is filamentary and so arranged as to offer great resistance and slight radiation, without importing into it anything which is not of the essence of the invention. No precise limitation upon the maximum diameter of the filament can be defined from the specification or is required as an element of the claim. The specification mentions by way of illustration the threads of linen or cotton which become more attenuated after carbonization and the carbon wire which after carbonization would be from four to five one-thousandths of an inch in diameter, while the smallest rods of carbon previously known were about a millimeter in diameter, thus having a cross section fifty times as great as the carbon wires. It is to be implied from the suggestions in the specification that it is to have sufficiently high total resistance for efficient use when the lamps are arranged in multiple arc, and to be used with leading wires of fine platinum. The claim is not limited to a carbon filament made of non-fibrous material. The conductors of the claim are the platinum wires mentioned in the specification. The receiver is the vacuum described in the specification. The peculiar method of securing the conductors to the filament, made a constituent of the first claim, is not imported into the second claim. A more exact interpretation of the meaning of the claim than has thus been indicated is not necessary in the present case, because each of the three lamps representing the kinds used by the defendant embodies the invention of the claim as thus interpreted.

It is of little import what Mr. Edison or his patent solicitor may have thought about the meaning of the claim during the pendency of the application for a subsequent patent, or that Mr. Edison may have supposed a resistance as high as 100 ohms in the burner would be required for use with the means of distribution which he expected to employ with his system of lighting. There are many adjudicated cases in which it appears that the inventor builded better than he knew; where a patent has been sustained for an invention the full significance of which was not appreciated by the inventor when it was made. In the case of the Bell telephone patent there was great room for doubt whether the speaking telephone had been thought of by Mr. Bell when he filed his application for a patent, but the court said; "It describes apparatus which was an articulating telephone, whether Bell knew it or not." 88 Blatch., 532.

The nearest approach in the prior art to the invention of the second claim is undoubtedly the lamp of Edison's French and English patents with a platinum burner. It seems almost preposterous to argue that the substitution of the carbon filament for the platinum burner of that lamp was an obvious thing to electricians. It would have been probable if there had been such a thing as a filamentary carbon in the prior art. But the nearest approximations to it were the ribbon shaped carbon burner of low resistance of Mr. Farmer (which was not a part of the prior art, but an isolated example known only to a select few) and the low resistance carbon rod burners of the patent of Sawyer & Man.

Undoubtedly the improvements that have been made in the art, such, for instance, as the method of electrical carbonization of the filament, since Mr. Edison's invention, have been of great value, and the perfected commercial lamp of to-day is far superior to the one which could be made by applying to the description of the patent all the knowledge and skill then possessed by those to whom it was more particularly addressed. But as was said by Bowen, L. J., in the Court of Appeals in England, "The evidence shows that lamps made solely on the patent will and do succeed, although subsequent improvements have been engrafted on the original design." It is impossible to resist the conclusion that the invention of the slender thread or carbon as a substitute for the burners previously used opened the path to the practical subdivision of the electric light.

The questions which have seemed the most meritorious of those argued at the bar have now been considered. Others, to which no reference has been made, have not been overlooked, and may be dismissed without discussion, and with the single remark that nothing which has been presented by the voluminous proofs and the exceedingly able and elaborate arguments of counsel seems to supply any valid reason for refusing to decree for the plaintiff. The usual decree for an injunction and accounting is accordingly ordered.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, Aug. 10, 1891.

The Gas Light and Coke Company.—The Legal Standard.—Mr. G. R. Hislop's Flat-Flame Burner.

The Gas Light and Coke Company, of London, have just issued their report for the first half of 1891, and the remarks made by the directors are of more than ordinary interest. The first paragraph mentions the fact that the directors will require to take about £160,000 from the reserve fund, in order to make up the amount necessary for dividends. As the balance available for dividend, from the six months working, is something under £200,000, it follows that the Company are going to divide nearly twice as much money as they have earned—a proceeding that would be regarded as extraordinary and calling for some explanation in most cases. But as I have remarked on a previous occasion, the financing of this undertaking is unique in its kind. In view of the rapid development of the electric light business in the district served by this Company, it should be at once explained that the deficiency in profits is in no way due to loss of business, for the directors go on to state that there has been an increase of nearly 10 per cent. in the quantity of gas sold. They refer to stoves and engines as to some extent accountable for this, but the recent severe winter was probably a more important factor, so far as the period in question was concerned. Any increase in the use of gas during the hours of daylight usually becomes more apparent during the summer months. In view of labor difficulties, and the requirements of colliery owners for a more even regulation of monthly deliveries of coal throughout the year, the directors have decided to increase the quantity stored during the summer. In this they have followed the custom adopted by most gas companies during the last year or two. It is known that the stocks of coal at the collieries are carefully watched. It is a regular occurrence now, about the beginning of December, to hear disquieting rumors circulated with a view of inducing gas companies to buy up coal, even at an increased price. Even if the supply of coal is guaranteed at the pits, there is the possibility of difficulties in freightage, as illustrated by the great railway strike in Scotland last year. The laying up of increased stocks necessarily means extra expense in handling, together with some deterioration in quality. But in these days of combinations, a large "bull" in the gas coal trade is not beyond the bounds of possibility. For several reasons, therefore, it is better to be provided with larger stocks than were formerly found to be sufficient. The idea of taking coal in equal quantities each month throughout the year is gaining ground. With increased facilities for transferring coal by means of machinery, it will probably be largely adopted.

The next paragraph in the reports is probably equal in importance to the foregoing. It sets forth that on account of the increased price of cannel, oil had been adopted as an enricher in the process of gas manufacture, with fair prospect of success; and that water gas plant was also being brought into use for similar purposes. According to papers read by engineers of the Company at recent meetings, the water gas apparatus is capable of producing 1,000,000 cubic feet of gas per day; and the accounts show that 2,378 tons of oil have been used during the six months. It may, therefore, be said that the use of materials other than coal has advanced beyond a merely experimental stage. I draw attention to this because there are some who seem to think that English gas engineers are prejudiced in favor of coal, and disposed to discourage at-

tempts in the way of water or oil gas. Perhaps there are still some recollections of the trouble caused by the attempted introduction of these agents 40 or 50 years ago, but these will not be allowed to stand in the way now. English gas engineers have certainly got used to coal, and when once one gets thoroughly acquainted with coal or any other material, he is not inclined to throw it over in favor of some (to him) unknown material, unless there is a substantial benefit to be gained by doing so. For some few years past there has been a disposition to bring liquid hydrocarbons into use on the large scale in the London gas works, but the hindrance has been the difficulty of obtaining a reliable supply. As soon as a steady supply is within reach, at a price that appears advantageous, gas engineers are willing to avail themselves of it. So with water gas. As soon as evidence is forthcoming that it is suitable to the requirements and to the systems of gas-fittings used by English gas consumers, and that it is cheaper to make than coal gas, no prejudice will hinder its introduction. But at the same time the gas suppliers in our principal towns are under heavy penalties both in regards to quality and pressure, and, therefore, are not in a position to bring in any new system unless they can see their way quite clearly.

Looking at the accounts, the cause of the diminished profits is evident. As regards sales, everything is very satisfactory. The increased quantity of gas sold, together with better returns for all the residual products, especially for coke, brings the gross revenue up to nearly 2,000,000, sterling, an increase of 15 per cent. or so on the corresponding period of last year. On the other side the expenses have gone up to nearly the same extent, leaving the actual profit earned something more than that for corresponding period of last year, when a heavy draw was also made upon the accumulated balances, for the payment of dividend. The increased cost of coal and wages goes far to explain the whole matter. And while no great saving under the latter head can be expected, it is satisfactory to notice that the coal contracts has been renewed at a much lower figure.

The London County Council have been somewhat exercised with regard to the question of the legal standard for testing gas, to wit, the sperm candle of six to the pound. They tried to get the Board of Trade to move in the matter, but the only response they can obtain, is the suggestion that they should at their own expense appoint a scientific committee to consider the subject of a suitable standard of light. This the Council are not inclined to do. They consider that the standard of light is a question of Imperial interest and not merely a local matter. Apart from that they are doubtful as to whether they have any funds applicable to a subject of this nature. But the real reason seems to be that they already have sufficient information on the subject, seeing that they have instructed their Parliamentary Committee to prepare a bill for the next session, for substituting a more exact standard of light for that now prescribed by the principal gas companies acts. It is rather singular that, although so much has been said against the candle in scientific circles, the London authorities are the only persons who have found any difficulty to arise in its practical working. I do not say that there has never been any discrepancy between the tests made by a gas company, and those of the local authorities in the district served by them. But these difficulties have been of a temporary character, and at any rate not of sufficient importance to rouse them to a sense of the need for a new standard. The proposed action of the London Council, if carried into effect, will bring out the views of authorities in other towns. And the suppliers of gas, of course, will have something to say on the subject. The London Council have certainly had several disagreements with the gas suppliers, but the points in dispute have turned more upon the construction of the photometer, and the effect of certain alterations introduced by the Gas Referees, than upon differences due to variations in the candles used. The gas suppliers say that the photometers of the new patterns give results a candle or two lower than those previously used ; or in other words, that they have to supply an improved quality of gas, in order to meet the official requirements.

An important paper was read at the recent meeting of the North British Association of Gas Managers, by Mr. G. R. Hislop, describing a new form of flat flame burner, specially adapted for gas testing purposes, in the case of gas of 20-candle power and upwards, which he calls the angleometer union gas burner. In a paper submitted to the Association three years ago, Mr. Hislop has pointed out that although the subject of pressure at the point of combustion has excited a great deal of attention, no one has referred to the angle of the impinging jets, or the dimensions of the flame as compared with the quality of the gas. An unduly spread flame would be exposed to over oxidation and excessive cooling effect, with a consequent reduction of lighting value. No special rule appeared to obtain as to the angle at which the holes in union jet burners were drilled, but they were usually between 45° and 60° from the perpendicular. But Mr. Hislop found by experment that the angle had a marked effect as regards the quality of the gas. For example, a 22½-candle gas gave the best results with an angle of 22° ; but at an angle of 45° the illuminating value appeared to be 19.7 candles. The dimensions of the flame were $3\frac{9}{16}$ of an inch high, by $2\frac{7}{16}$ inches wide in the first case ; but $2\frac{9}{16} \times 3\frac{1}{16}$ wide in the second. So it appears that the best results may be looked for, in a flat flame burner, when the height of the flame is greater than the width. A considerable number of tests were given, the results of which showed that the lower the quality of the gas the lower should be the angle. Taking various qualities of gas, an 18-candle gave the best result with angle of 18°, and there is a steady progression up to an angle of 45° for 32½ candle gas.

To arrive at these results it was necessary to provide a large number of burners, each drilled at a particular angle ; and there was a considerable loss of time in changing burners, with a view of getting at the best result. The angleometer burner described on the present occasion is so contrived that the angle of impingement can be varied and adjusted to any desired degree, thus admitting of the experiments above referred to being carried on with a single burner, and the highest results can be roughly approximated to in a very short time. Mr. Hislop illustrated the higher result shown by a narrow, as compared with a wide flame, by means of his burner. The principal lesson to be drawn from his researches is, that especially with gases of under 20 candle power a narrow flame will give the best results, and that an important loss of value is caused by the usual plan of consuming such gases through burners giving wide flames.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. A. A. Franzheim, Secretary of the Board of Gas Trustees, Wheeling, W. Va., writing under date of August 14th, says : "Mayor C. W. Seabright, of this city, to-day, on behalf of the city, signed contract with Mr. Charles S. Knight, of the Fort Wayne Electric Company, for a plant of 400 arc lights of 2,000-candle power each. The installation, to include Hamilton-Corliss engines, the necessary shafting, clutch pulleys, etc. The cost of plant, including buildings, etc., is put at $100,000."

A sequel to the fatal suffocations, at the works of the Worcester (Mass.) Gas Light Company on May 16th, is shown in the institution of suits for damages brought, respectively, by Mrs. McNamara, widow of Michael McNamara, and Patrick Conlin, as administrator of the estate of Patrick Hamilton. McNamara and Hamilton lost their lives, on the date above mentioned, through inhaling gas while making a change in some of the works' connections. Each suit is for $5,000 damages, Mrs. McNamara being represented by Messrs. Potter & Aiken, while the Hamilton estate have employed Messrs. O'Hara & Carroll, of Pawtucket, R. I., to conduct their case. The suits are brought under the Employer's Liability Act of the State. The Gas Company is fully protected in the matter, in that it carries an insurance policy upon its employees in the Employer's Liability Company, of Boston, which corporation will defend the cases.

It is said that a Gas Company has been incorporated at Celina, O., with a capital of $50,000. This place, which is the capital of Mercer county, is located on the Wabash river at a point 30 miles southeast of Lima, O., and is 105 miles west-northwest of Columbus. Although it is a growing place, with the likelihood that it will in time be of some importance in the commercial world, we are nevertheless of the opinion that a gas works there will not yield much profit in the immediate future. Its population certainly cannot exceed 3,500, if indeed that estimate is not altogether too high.

In our last we noted the resignation of Messrs. Charles F. Woodward (President), and R. P. Buzzell and Ezra M. Southworth (Directors), from the Citizens Gas Light Company, of Wakefield, Mass., these gentlemen having disposed of their interest in the Company to Mr. H. C. Buck. At a subsequent special meeting of the stockholders, the Rev. E. H. Capen, of Tufts College, and Messrs. T. S. Pearson and A. L. Mariner, were elected to the vacancies in the Board. The Rev. Mr. Capen was then elected President.

Mr. J. F. Seaman has resigned the Superintendency of the Cumberland (Md.) Gas Light Company, in order that he might accept the position of Manager of the United Light Company, of Uniontown, Pa. He will take charge at Uniontown on the 1st of October.

The Newport (Ky.) Light Company is removing its gas meters from places the occupants of which are using incandescent electric lights, re-

lying upon the gas meter merely as an insurance against a breakdown in the electric service.

SUPERINTENDENT MILLER, of the Marquette (Mich.) Gas Light Company, has made many extensions to the Company's main lines this summer, and is confident that the new lines will be well patronized this winter.

IF rumor is to be believed—and this time we think it is—Cincinnati, O., will be the next city to enjoy dollar gas. General Hickenlooper always was a champion of low gas rates.

MR. JAS. K. WARDNER, of Fairhaven, Montana, is our authority for the statement that the Blue Canyon coal mines—the mines are some 4 miles southwest of Fairhaven—are producing an excellent quality of gas coal.

THE offices of the Haverhill (Mass.) Gas Light Company, on Merrimac street, are to be refitted and refurnished in elegant style.

IT is reported that the North Attleboro (Mass.) National Bank has filed a petition in the Norfolk registry, at Dedham, praying for insolvency proceedings against the Citizens Gas Light Company, of Quincy, Mass. The first hearing in the case will be held at Dedham on Wednesday, Sept. 16.

COLONEL HENRY ELSDALE, of the British Royal Engineers, claims to have discovered a certain and rapid means of resuscitating persons from the effects of suffocation. A sapper among the men under his command at Chatham was one day found enveloped in the folds of a half empty war balloon. The coal gas with which it had been inflated had suffocated him, and to all appearances he was a dead man. But efforts were made to restore him, though the pulseless heart and cadaverous face of the sufferer gave no encouragement to persevere. In a moment of something like inspiration it occurred to Col. Elsdale to send for some tubes of compressed oxygen which had been prepared for the oxy-hydrogen light. The pure oxygen, at a very high pressure, was hurriedly conveyed to the mouth of the prostrate sapper, by means of inserting the nozzle of the valve between his teeth, and the supply was "gently turned on to the smallest extent." The effect was absolutely instantaneous. In an instant he opened his eyes and seized the nozzle between his teeth. In short, the sapper not only thoroughly revived within a few minutes, but in half an hour walked away, quite well, to the barracks, and refused to go to the military hospital, as was suggested by his commanding officer. Of course, the objection will be raised that everybody has not tubes of pure oxygen at high pressure in readiness to apply to such cases. Happily, oxygen in quantities as large as those administered is not needed, and it can be stored in small, strong bottles, made of the finest steel, with a valve giving an absolutely hermetic seal. These vessels may be as small as a soda-water bottle, and may be made part of the medical stock of every doctor. Oxygen at any degree of compression required can, in fact, now be obtained, and the whole apparatus for restoring vitality can be packed in a small box, quite portable. It is claimed that it is equally available for those persons who have been asphyxiated by choke damp in coal mines or by ordinary illuminating gas. People apparently drowned, and those insensible from long exposure in the rigging of a ship, might also be saved from an untimely end by what Col. Elsdale calls "a dose of oxygen." It would properly be invaluable, too, in cases of suffocation from the fumes of charcoal, or in cases where chloroform had operated injuriously on a weak heart.

THE Gas Committee of Minneapolis (Minn.) Councils has made the following estimate of the cost of street lighting for the ensuing year:

3,100 gas lamps, at $15.63 each	$48,453
2,500 gasoline lamps, at $14.40 each	36,000
500 electric arc lamps, at $148 each	74,000
30 incandescent lamps, at $15.50 each	405
Additional lamps	5,000
Incidentals	500
Total	$164,418

This is an increase of $4,000 over the present year, and is intended to cover the $4,000 debt of the former gas committee, which the present committee had to pay. The electric lights are put in at $148 each, the contract providing that when 500 lamps were in use the price should be $148 instead of $150. The 500 limit has just been reached.

WE again call attention to the fact that the executive officers of the National Gas Light and Fuel Company have been removed to 52 Lake street Chicago, where Manager F. H. Shelton will be glad to welcome gas men visiting the city. His invitation is extended in the following words: "When in Chicago—whatever your business in the city may be—you are cordially invited to make our office your business headquarters. Mail, telegrams, packages, etc., may be addressed to our care, and a private room for writing, fitted with stationary, city and business directories, maps, daily papers, etc., is at your disposal. In addition, our office—located but a few steps from the main thoroughfare, State street—is in the midst of the wholesale machinery and gas supply district. Within a stone's throw are headquarters for meters, stoves, lamp posts, Welsbach and high candle power gas lamps, valves, pipes and other gas supplies. We sincerely extend the invitation and trust that you will avail yourself of it."

MR. D. P. MYERS, Superintendent of the Minnesota State Reformatory, advertises that proposals will be received, at the Mayor's office, St. Paul, up to noon of September 3d, for the furnishing of an electric lighting plant for the reformatory buildings, which we believe are located at St. Cloud. The specifications call for: "Dynamo of 4,000-candle light power; 17 2-light chandeliers; 7 3-light chandeliers; 169 brackets; 61 drop lights; belting and pulleys; branch wire lines to barn and Superintendent's residence." The work of installation is to be completed on or before November 15th.

THE Central Trust Company, of New York, began a foreclosure suit, on the 13th inst., for $350,000, which it holds as trustee of a mortage for $350,000 on the plant of the Metropolitan Gas Company, of Elizabeth, N. J. The papers, which have been served on the Gas Company's attorneys, state that the suit is brought in the Court of Chancery on account of a default having been made in the payment of the interest on the bonds given to secure the mortage.

THE San Antonio (Texas) Gas Company is putting in an ammonia separator. Mr. J. H. Fitzgerald, of St. Joseph, Mo., has the contract for the work.

ON Wednesday, of this week, the Toledo (Ohio) Board of Natural Gas Trustees will open bids for "furnishing and laying the following quantities of cast iron, wrought iron or steel pipe, either of lead or screw joint: 12,000 feet of 10-inch; 95,000 feet of 6-inch; 128,000 feet of 4-inch; 51,000 feet of 3-inch: 2,000 feet of 2-inch." The specifications also call for figures on the "necessary fittings."

THE Committee on Light, of the Richmond (Va.) Board of Aldermen recently reported an ordinance recommending that $25,000 be set apart for the installation of an auxilliary water gas plant in the city gas works.

"OBSERVER" under date of the 15th inst., forwards the following: "The Hon. Phineas Jones Stone, an honored ex-Mayor of Charlestown, Mass., and who was prominently identified with the Charlestown Gas Company, died at his home, on the 12th inst., after an illness of about four weeks. Deceased, who was in his 82d year, was a native of Weare, N. H. but had resided in Charlestown for about 60 years and enjoyed the respect and confidence of the people of that district. In early life he was engaged in the grocery business, but for the past 25 years Mr. Stone devoted his energies to the advancement of the City Savings Bank of Charlestown and the prosperity of that institution is largely due to his sagacity and faithful labors. Mr. Stone was one of the most patriotic gentlemen of this city during the war of the rebellion. As an instance of his liberality and enthusiasm for the Northern cause it may be stated that Mr. Stone and his brother equipped and uniformed at their own expense and sent to the front a full company, known as the Stone Guards. He leaves one son, Mr. Joseph Stone, former manager of the Pacific Mills, whose wife was the daughter of the late lamented Horatio Harris."

MR. C. L. PHILLIPS, Secretary to the Board of Water Commissioners, of Dalles City, Ore., will receive sealed proposals for lining with asphaltum the reservoir and receiving basin of the Dalles City water works. The surface to be covered is equal to 31,850 square feet. The competition will close at 2 P.M. of Friday, September 4.

CAPTAIN LUSK, of the Engineer Corps, District of Columbia, recommended to the local Commissioners that the Washington Gas Light Company be required to furnish a written report each week to the authorities, detailing the exact location, dimension, etc., of every opening made by the Company in the streets. The purpose of this record is to enable the "department to estimate with precision the amount of money required for the repairs necessary." The recommendation was adopted without discussion and the order is to go into effect at once.

A CORRESPONDENT of Wilmington, Del., forwards the following: "Proposals will be received, until 8 P.M. of Tuesday, September 1, for lighting the streets of this city by gas and electricity for one, three and five years, commencing Friday, January 1, 1892. Proposals for gas lamps must include the furnishing of gas, lighting and extinguishing the same, also the cleaning of the lanterns and the keeping of the same in good order. All the burners must pass 5 ft. per hour, and the gas is to be of not less than 16-candle power. Proposals for electric lights must include the furnishing of arc lights of 1,200 to 2,000-candle power, the incandescent lamps to range in lighting power from 16 to 24 candles. There are now in operation in the city 810 gas lamps, 33 arc electric lights and 382 incandescent electric lights. The Board of Directors of the Street and Sewer Department reserve the right at any time to change the manner of lighting any lamp or lamps now in use or that may hereafter be in use in the city. The schedule now in use in lighting the public lamps will be followed. Any failure of the lamps, on account of not being lighted and kept burning all night, will be reported daily by the Police Department to the Secretary of the Board, and he will keep a record and notify the contractor of all failures so reported, and the contractor will be required to forfeit double the contract price per lamp for each lamp so reported and not burning."

THE East Albany (N.Y.) Gas Light Company will furnish the adjoining town of Bath with electric lights for street lighting.

A RECENT issue of the Macon (Ga.) *Telegram* says that Capt. Wilcox has just finished a big task in overhauling and fixing up the local gas works. The plant is now in first class shape, the last traces of the mismanagement of the "Philadelphia capitalists," whose control of the Company was short-lived, having been completely wiped out. The new water gas apparatus, which will be ready for operation about October 1st, will almost double the present manufacturing capacity.

THE authorities of Leesburg, Va., will, up to the 29th inst., receive sealed proposals for lighting the streets either by electricity or gasoline.

ON Friday next the voters of Little Falls (N. Y.) will be called upon to decide whether or not the sum of $10,000, or as much thereof as may be necessary, should be expended in lighting the streets by electricity. This is the estimated cost for one year's lighting, according to the schedule proposed by the authorities. The Little Falls Gas Company stands ready to take up the work, and offers to carry it on under the Sperry, Fort Wayne, or Thomson-Houston systems, as the town may elect.

THE following account of the West Chester (Pa.) Gas Company is from a local source: "No review of the manufacturing interests and internal improvements of West Chester would be complete without special notice of the West Chester Gas Company. Founded in 1852, these works have been successfully operated for over 39 years, and today, notwithstanding the introduction of electric lighting, the Company's business presents a deservedly prosperous aspect. The importance to a town of ample and effective lighting cannot be overestimated. In this particular West Chester enjoys advantages equaled by few towns and excelled by none. The mains of this Company reach every part of the town, and over 11 miles of 10, 8, 6, 4, and 3-inch pipe are used in making the connections necessary to supply the 900 customers. The manufacturing capacity of the plant of the Company is 100,000 cubic feet per day, with a storage capacity of 75,000 cubic feet. The average candle power of the gas for the year 1890 was 19¾. The high quality of the gas furnished by this Company, coupled with the low cost at which it is supplied, has caused the business to show an annual increase. The capital stock is $61,200, and the financial affairs of the Company are in a very prosperous condition, there not being one dollar of bonded or floating debt, and the stock pays a yearly dividend of 8 per cent. Much of the stock is held in trust, being regarded as a safe as well as paying investment. The officers of the Company are: President, Dr. Jesse C. Green; Secretary and Treasurer, H. B. Buckwalter; Superintendent, Major Levi G. McCauley; Assistant Superintendent, W. S. Bowen; Directors, Dr. Jesse C. Green, Levi G. McCauley, Evan Rogers, H. Buckwalter, Bentley Worth, C. S. Bradford, and J. B. Gray. To the untiring industry and application of Mr. W. S. Bowen is due in a large measure the success of the Company. He is a man of high character, and has proven an assistant not only in name but in fact, and has by his sterling integrity commended himself to the Board of Directors and officers of the Company, as all with whom he is brought in contact. He is a graduate of the West Chester High School. Dr. Green has held the office of President for five years. His immediate predecessor, the lamented M. B. Hickman, held the position for 14 years. While we believe that none of the gentlemen who have so ably managed the affairs of this Company desire any personal publicity, yet we may be pardoned if we say a few words about the gentleman who has for 18 years discharged the duties devolving on him as Superintendent, and to whose untiring and aggressive energy and enterprise a large measure of the success attending the Company is due. Major McCauley is a native of Chester county. At the outbreak of the war he enlisted as a private in Company F, 7th Pennsylvania Reserves. He was promoted to the First Lieutenantcy of Company C, of the same regiment. At the battle of Charles City Cross Roads, June, 1862, he lost an arm. When he recovered from his wounds he returned to active service, wearing the bars of a Captain. He was soon afterwards transferred to the staff of the Department of Washington, and there remained until June, 1866, when he was mustered out of the army after being brevetted Major for gallant and meritorious services. Returning to West Chester he has labored as earnestly in business life for the improvement of his town as he did gallantly in war for the perpetuity of republican institutions. From 1869 to 1872 he held the office of Register of Wills for Chester county, was for many years President of the Good Will Fire Company, Chairman of the Republican County Executive Committee, and a Director of the West Chester Wheel Company. He is at present a Director of the Farmers National Bank and the Coatesville Gas Company, and a Trustee of the State Normal School. In all the positions he has been called on to fill he has discharged the duties devolving upon him with fidelity and in such a manner as to win and receive the approval of his associaties and fellow-citizens. He has often been solicited to accept offices within the gift of his party, but has always refused. Should he consent to become the servant of the people in official position, he would be one who would consider 'public office as a public trust,' and his fellow-citizens would, in honoring him, honor themselves.

MR. FREDERIC PEASE, late Treasurer of the East Boston (Mass.) Gas Company, will, it is said, represent Ward One in the next legislature of the Bay State.

THE new electric light plant for the Pawtucket (R. I.) Gas Company will be very substantial. The dynamo room will be 60 feet by 150 feet, the engine room 58 feet by 78 feet and the boiler room 60 feet by 60 feet. The side walls will be of brick with iron roof covered with corrugated iron. The whole plant will be built by the Berlin Iron Bridge Company, of East Berlin, Conn., after plans and specifications furnished by Messrs. Remington & Henthorn, Engineers and Architects, Providence, R. I.

PATERSON, N. J., has had enough of incandescent electric lamps as street illuminators. They are to be replaced by high candle power arcs.

THE following bids were recently made by the named companies in competition for the public lighting of Youngstown, O.: Mahoning Electric Light Company—arc lights, nominal 2,000-candle power, 1 year contract, $90 per lamp; two years, $85; three years, $80; 5 years, $67.50. Lighting on Philadelphia schedule. Additional hours at proportionate rates. Youngstown Electric Light Company—2,000-candle power, nominal, for a period of 5 years, $68 inside of the old city limits, and $75 outside of the new city limits, Philadelphia lighting table. Additional hours, exact proportion of above rates.

IT is said that George Cooper, who is employed by the city of Denver, Col., at a salary of $125 per month, to report cases of imperfect lighting under the arc system, as per the public lighting contract with the Denver Consolidated Electric Light Company, also receives $125 per month from the Company as its own inspector. As a correspondent puts it: "As inspector of electric light wiring for the city it is George T. Cooper's duty to traverse the city each night in search of a poor light. As inspector for the Denver Consolidated Electric Light Company it is his duty to traverse the city each night to see that the lights are burning. As city inspector it is his duty to report any defective lighting to himself as the Company's inspector, and insist that he as representative of the Company shall remedy it. As inspector for the Company it is his duty to convince himself as inspector of the city that the light is all right and needs no repairing. Then as city inspector he should report to the city auditor that the Company's inspector, himself, had refused to attend to the light, when he, as city inspector, has pointed it out. If the light continues in a faulty condition, as city inspector it is his duty to report to the Company that its agent (himself) is derelict of duty, and insist that it 'fire' its inspector (himself). Then, as representative of the Company, it would be necessary for him to complain to the mayor that the city inspector (himself) was too particular and too ready to find fault, and insist that he be called down. As city inspector he must report every month all failures of himself, as the Company's inspector, to keep the lights in proper shape."

The Market for Gas Securieties.

The market is in an abnormal condition, and the never-ending conflict between the bulls and the bears is this week in favor of the former. As a consequence Consolidated moved up sharply to 95–97, at which the opening quotation was made to-day—Friday. Although this is a nominal advance of 2½ points over the bid price of a week ago, it should be borne in mind that not over 200 shares changed hands in the week, which goes to show that quotations on the Exchange in this specialty are not of much value. Other city shares are listless, although inquiries for purchase about them are of much more frequent occurrence than offers for sale. In Brooklyn shares the feature is the weakness in Williamsburgh, and similar symptoms in respect of Fulton-Municipal. Citizens is also a trifle off, while Nassau and old Brooklyn are steady. Old Brooklyn and Fulton are purchases at the quoted figures, beyond a doubt. In out-of-town shares Chicago gas is steady at 47 to 47¼, while Laclede common droops, at 15 to 15¼. All the bond issues are fairly steady.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

August 24.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	95	97
Central	500,000	50	—	90
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	118	120
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	118	121
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	—	48
Preferred	5,000,000	100	—	90
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	—	98
Citizens	1,200,000	20	—	78
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	114	—
" Bonds	300,000		100	105
Peoples	1,000,000	10	—	70
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	—	95
" Bonds (5's)	70,000	—	—	—
Nassau	1,000,000	25	131	—
" Ctfs	700,000	1000	98	100
Williamsburgh	1,000,000	50	100	—
" Bonds	1,000,000	—	105	109

For Sale, Cheap,

On account of change to electricity.

ONE GASHOLDER, in good order. Diameter, 38 ft.; depth, 16 ft.

THREE CAST IRON RETORTS, with mouthpieces complete, made by Holyoke Machine Shop. Never fired. Size, inside: Length, 7½ ft.; mouth, 12½ x 20 in. Also,

ONE SET FIREBRICK for bench of three retorts.

Any part or all will be sold cheap to close.

GLASGOW COMPANY,

846-3 South Hadley Falls, Mass.

EMPLOYMENT DESIRED

In a small gas works by a competent man of twenty years' experience. Sets his own benches; a good gasfitter. Thoroughly versed in all work done in a small gas works, and guarantees satisfaction. To such as desire a steady man wages will be arranged satisfactorily. Address "GAS MAN,"

846-1 200 Jones St., Rochester, N. Y.

Position Wanted

AS SUPERINTENDENT OF SMALL GAS WORKS

By a young man fully experienced in the details of construction, manufacture and distribution; also in fitting, main laying, etc. Best of references. Address

846-2 "A. W.," care this Journal.

WANTED,

A Man who Thoroughly Understands Making Sulphate, or Salts of Ammonia.

Address PEORIA GAS LIGHT AND COKE CO.,

845-4 Peoria, Ill.

SUPERINTENDENT WANTED,

By Gas Company who also operate an Electric Light Plant. Must be thoroughly competent in all matters pertaining to the construction and operation of the gas works, and also understand steam and have had experience in running electric lights. Must give good references and be a worker. Address, with full particulars concerning themselves and references, also stating salary expected, TREASURER GAS AND ELECTRIC CO.,

842-tf Care this Journal.

Gas Stock for Sale.

$10,000 to $12,000 of the Stock of a Gas and Electric Light Company.

To someone competent to assume the management of the business, and who is familiar with both gas and electric work.

844-tf Address "GAS STOCK," care this Journal.

Engagement Desired

As Superintendent or Assistant Superintendent of a Coal Gas Works.

By a young man having 12 years' experience as Foreman. Best of references. Address FOREMAN,

844-4 Care this Journal.

POSITION DESIRED

As Superintendent of Gas Works,

By a man fully competent to take entire charge of construction, manufacture and distribution of either coal or water gas. Best of references. Address "WESTERNER,"

844-tf Care this Journal.

MOSES G. WILDER, MECH. ENGR.

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Volumetric Lamp Governors

FOR GAS LAMPS & HIGH-POWER BURNERS.

Governor Burners for Street Lamps & General Use

GOVERNORS FOR ARGAND AND OTHER COMMON GAS BURNERS IN ALL SIZES.

Horizontal Governors

Specially Adapted for Gas Stoves, Furnaces, etc,

It is well known that a large majority of all High Power Gas Lamps in the United States have my Governors attached, and they are always used by the leading makers of these lamps. To remove any excuse for the use by anyone of inferior and infringing Governors, a reduction in price has been made, and all exclusive contracts are cancelled.

Correspondence Solicited with all who require a Reliable Governor.

The Weston Standard

VOLTMETERS AND AMMETERS.

These Instruments are the most accurate, reliable, and sensitive portable instruments ever offered. A large variety of ranges, to meet the requirements of all kinds of work.

Send for Catalogue.

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GAS NAPTHA DEPARTMENT OF THE WEST.

GAS NAPTHA.

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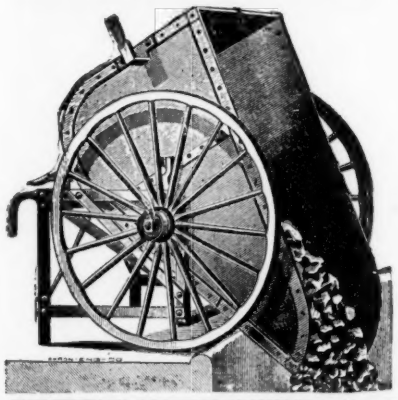
CLEVELAND, OHIO.

McNeil's Balanced Charging Barrow.



UNSOLICITED TESTIMONIAL.

POUGHKEEPSIE, N. Y., July 25, 1891.

MR. GRANT MCNEIL: Dear Sir—We find, after using your dumping barrow for over a year, that it is as good as when we got it. It paid for itself in three months. We cannot recommend it too highly. We handle broken coal, which will wear out an ordinary barrow in two years. Yours truly,

POUGHKEEPSIE GAS COMPANY.

Only perfect satisfaction could induce a man to voluntarily send a letter like that.

GRANT McNEIL, 225 N. Union St., Akron, O.

KIRKHAM, HULETT & CHANDLER'S NEW PATENT

"Standard" Washer-Scrubber.

Extracts the Whole of the Ammonia and a Large Percentage of the Sulphureted Hydrogen and Carbonic Acid.

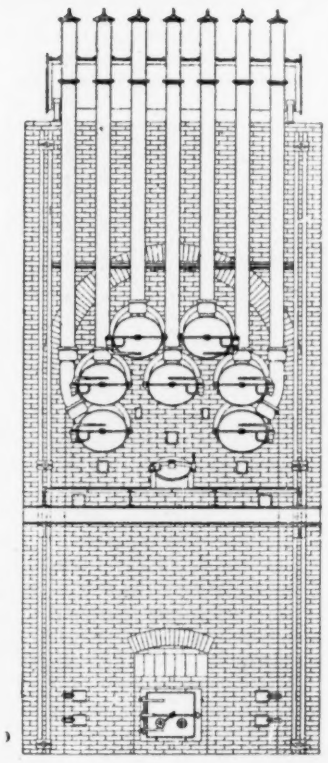
MINIMUM WEIGHT IN MOTION • MINIMUM DRIVING POWER • MINIMUM BACK PRESSURE • MINIMUM WEAR AND TEAR • WITH MAXIMUM RESULTS.

The "New" Washer-Scrubber, with Wooden "Bundles," has been for many months in successful operation at the London Gas Light and Coke Company's station at Beckton, and at many other European Gas Works The "Bundles" can be supplied to "Standard" Washer-Scrubbers already in use.

GEO. SHEPARD PAGE, Sole Agt. for Western Hemisphere, 69 Wall St., New York.

LACLEDE FIRE BRICK MANUFACTURING COMPANY,

ST. LOUIS, MO.



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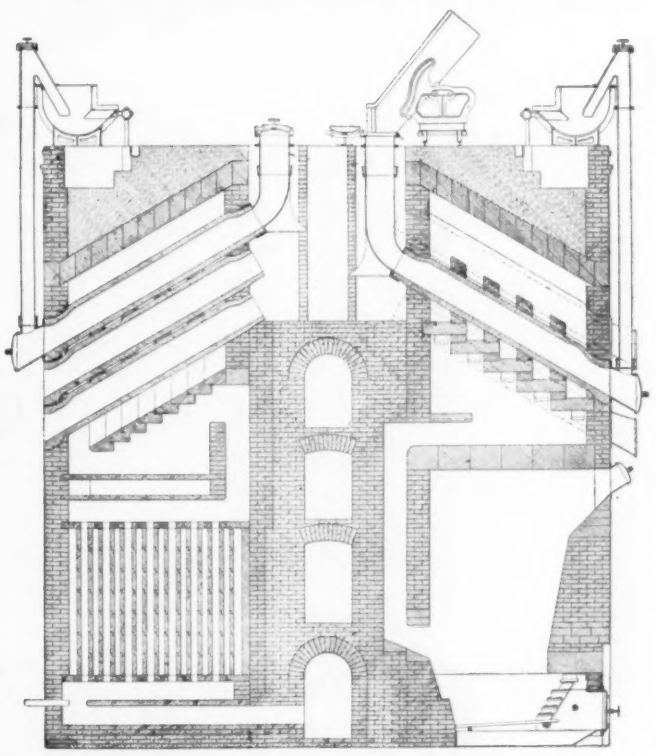
Coze System of Inclined Retorts.

IT IS THE COMING BENCH FOR MAKING COAL GAS.

It will Save from 50 to 60 per ct. in Labor.



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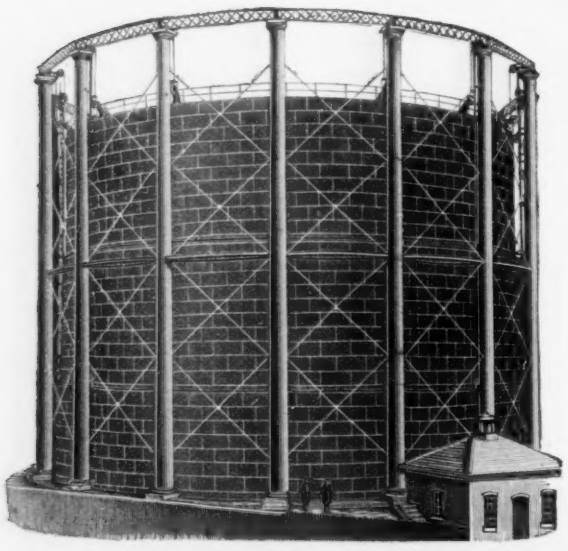
The Continental Iron Works

THOS. F. ROWLAND, President. THOS. F. ROWLAND, Jr., Secretary & Treasurer. WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.

Take 10th or 23d Street Ferries from New York to Greenpoint. **BROOKLYN, N. Y.**



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SINGLE-LIFT and MULTIPLE-SECTION GAS HOLDERS A SPECIALTY.

Wrought Iron Gas Holder Tanks.

BENCH CASTINGS, RETORT LIDS,

Hydraulic Mains, Condensers, Scrubbers,

PURIFIERS, VALVES, Etc.

SELF-SEALING

Retort Mouthpieces and Lids.

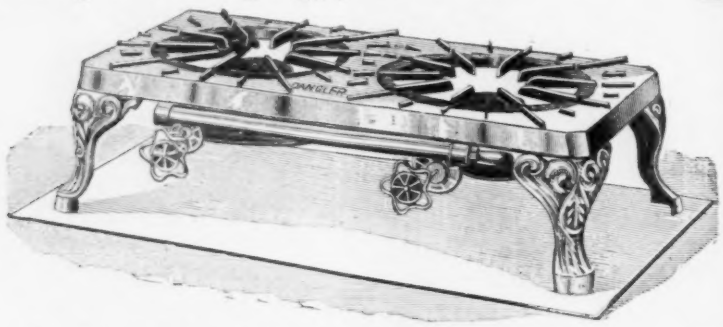
For Round, Oval, or "D" Retorts.

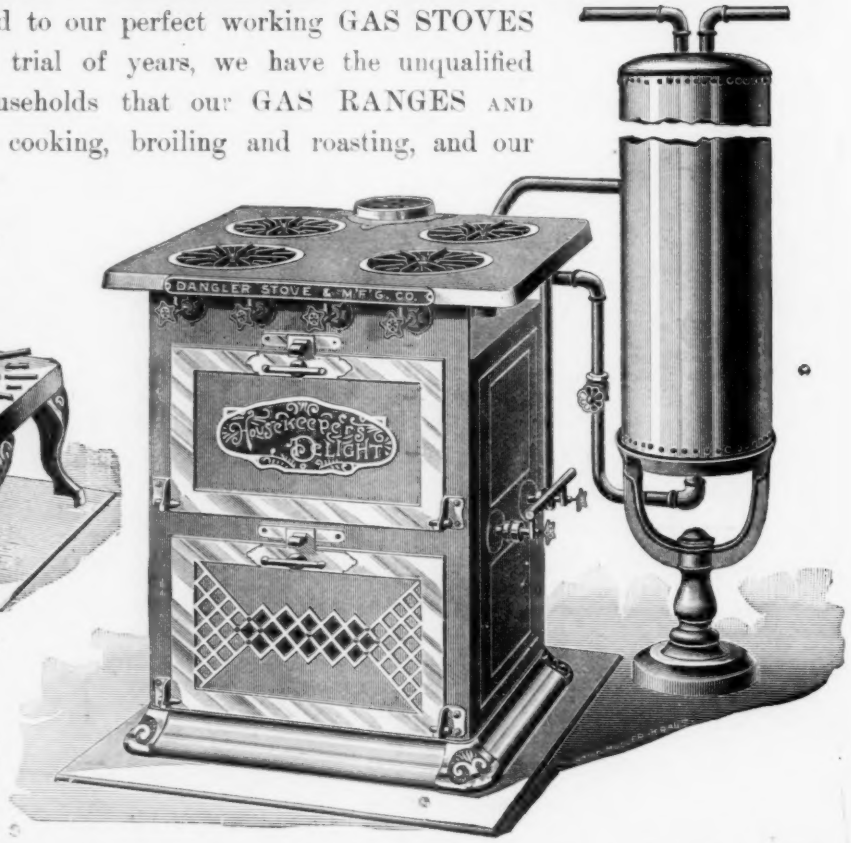
THE DANGLER GAS RANGES AND STOVES.

In calling the attention of those interested to our perfect working GAS STOVES AND RANGES, after a thorough and rigid trial of years, we have the unqualified assurance from the heads of over 6,000 households that our GAS RANGES AND STOVES are a perfect success for baking, cooking, broiling and roasting, and our

HOT WATER DEVICE

is a marvel of convenience and economy, furnishing an unfailing supply of hot water.





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Hot Plates,

which are especially popular on account of the size and style, and finished either in nickel or polished iron.

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MANHATTAN FIRE BRICK AND ENAMELED CLAY RETORT WORKS.

ADAM WEBER, Prop'r,

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Modern Recuperative Furnaces

FOR FIRING COAL GAS AND FIXING BENCHES, ALSO INCLINED AND VERTICAL RETORTS.

The most successful Furnace in America in competition with all others. Results equalled by no other Furnace. Full or Semi-Regenerative. Superior to all others in strength of construction and prolonged life of Retorts and Furnace.

CHAPMAN VALVE MANUFACTURING CO.,

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Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants With and Without Independent Nozzle Valve. All Work Guaranteed.

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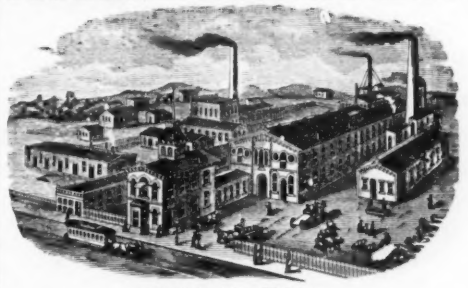

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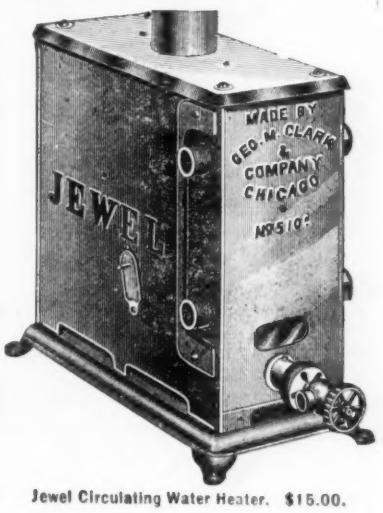

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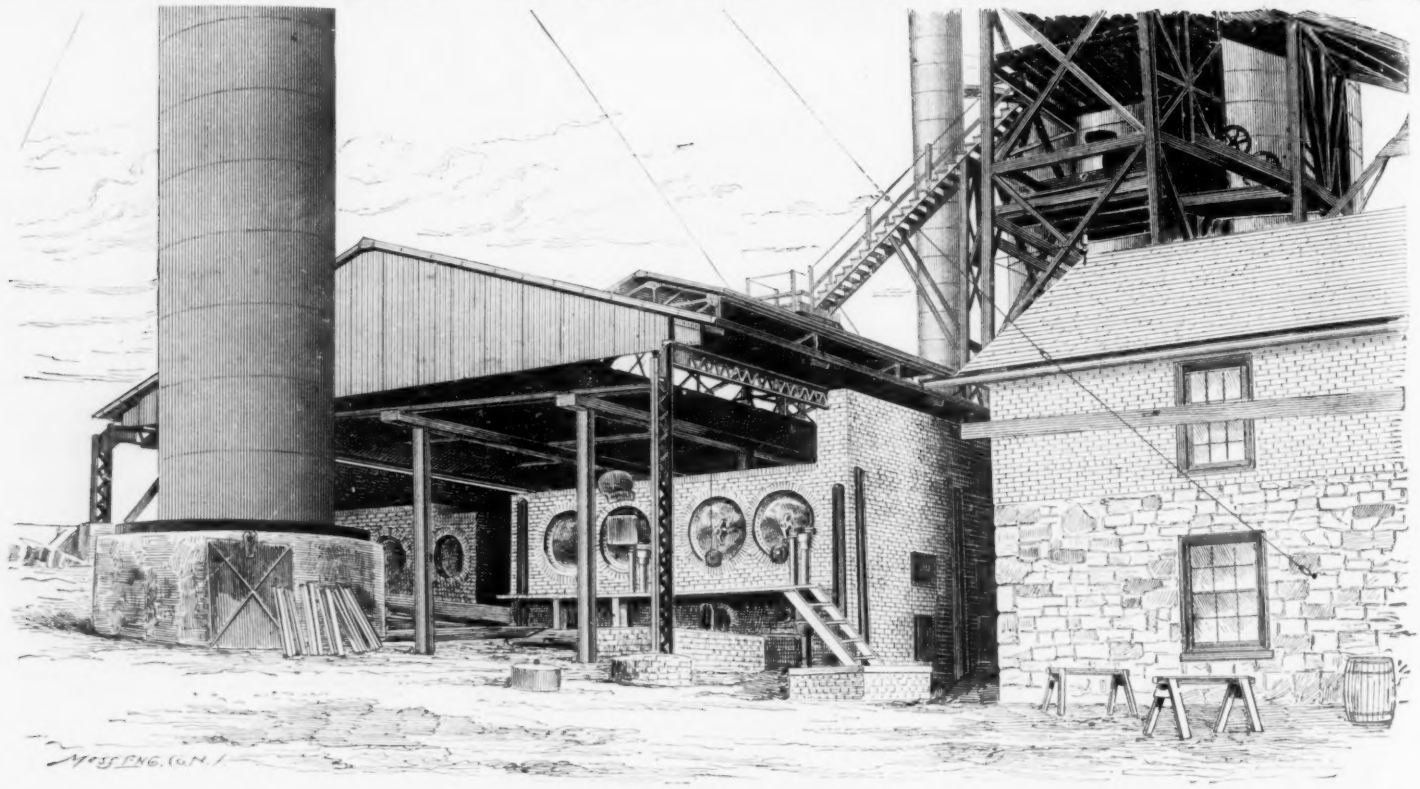

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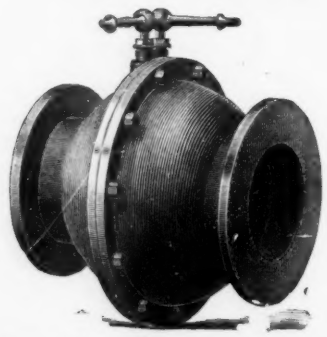

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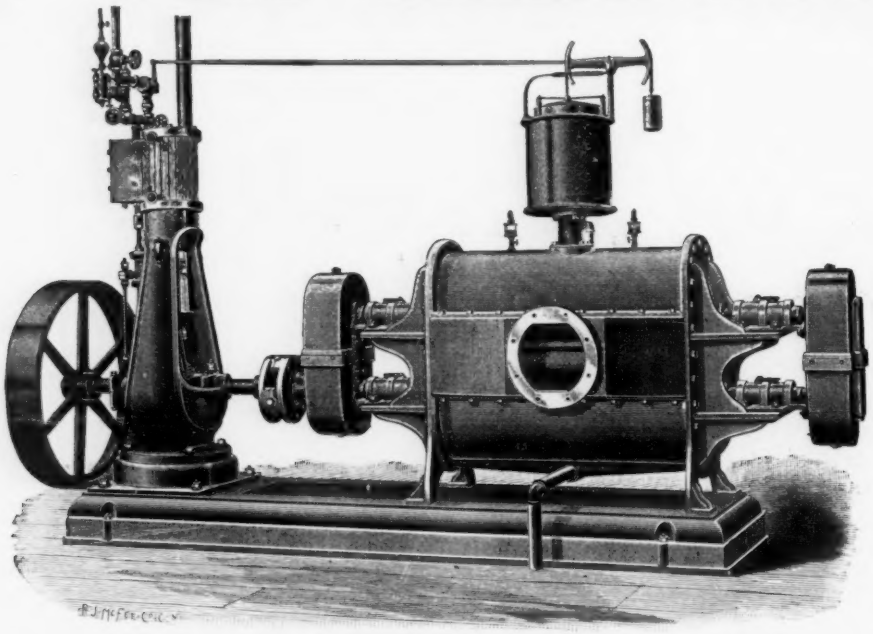

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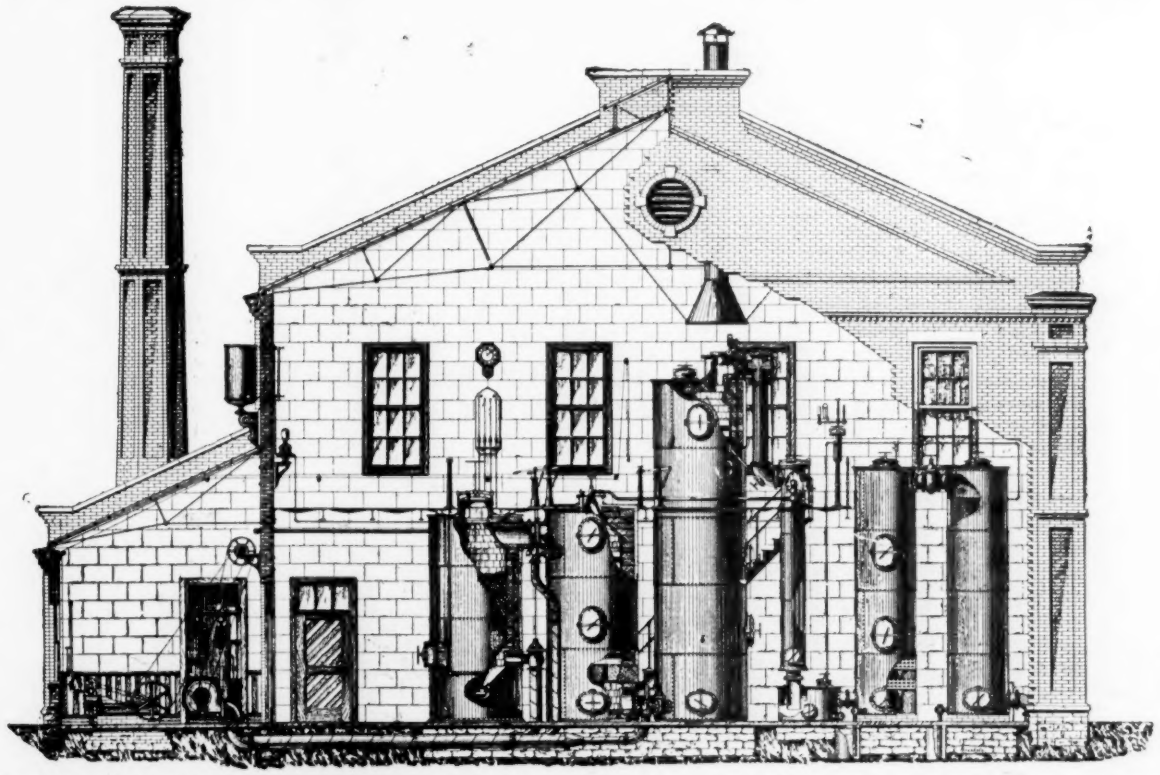

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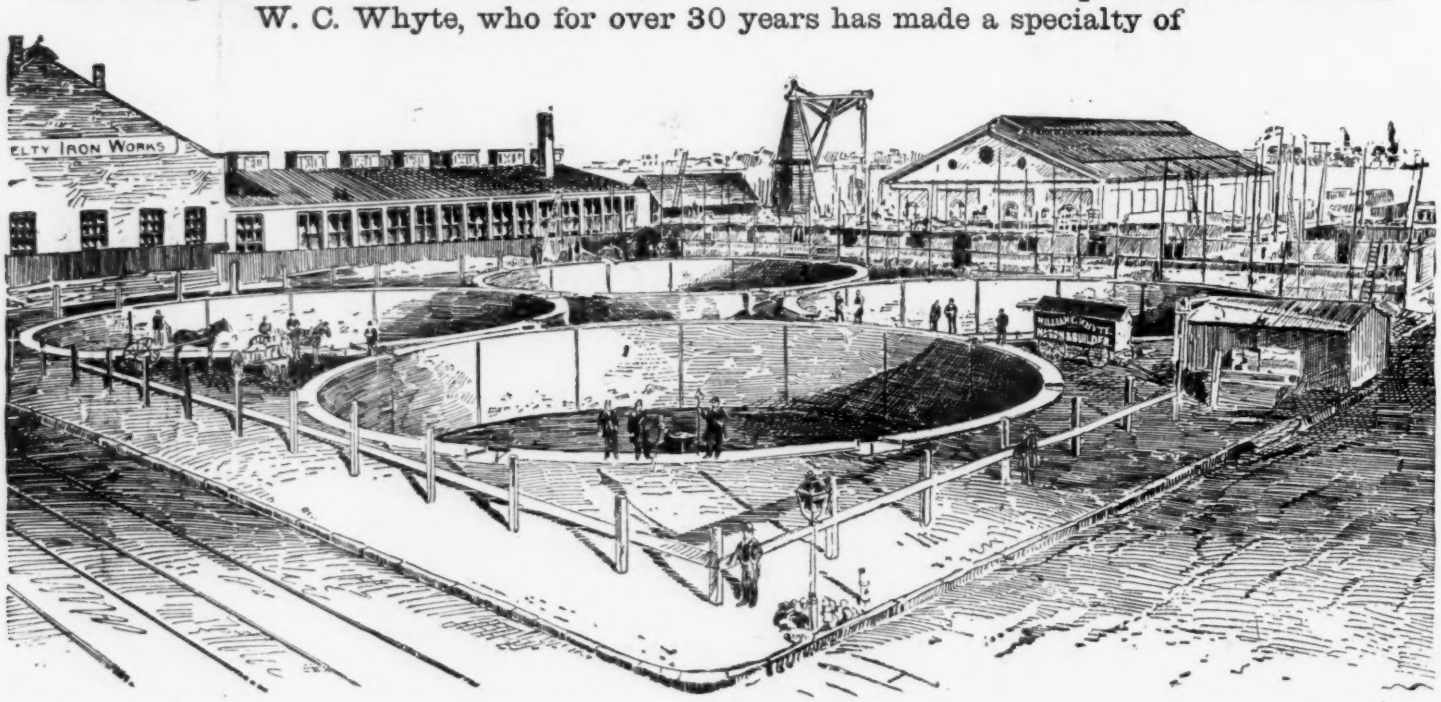

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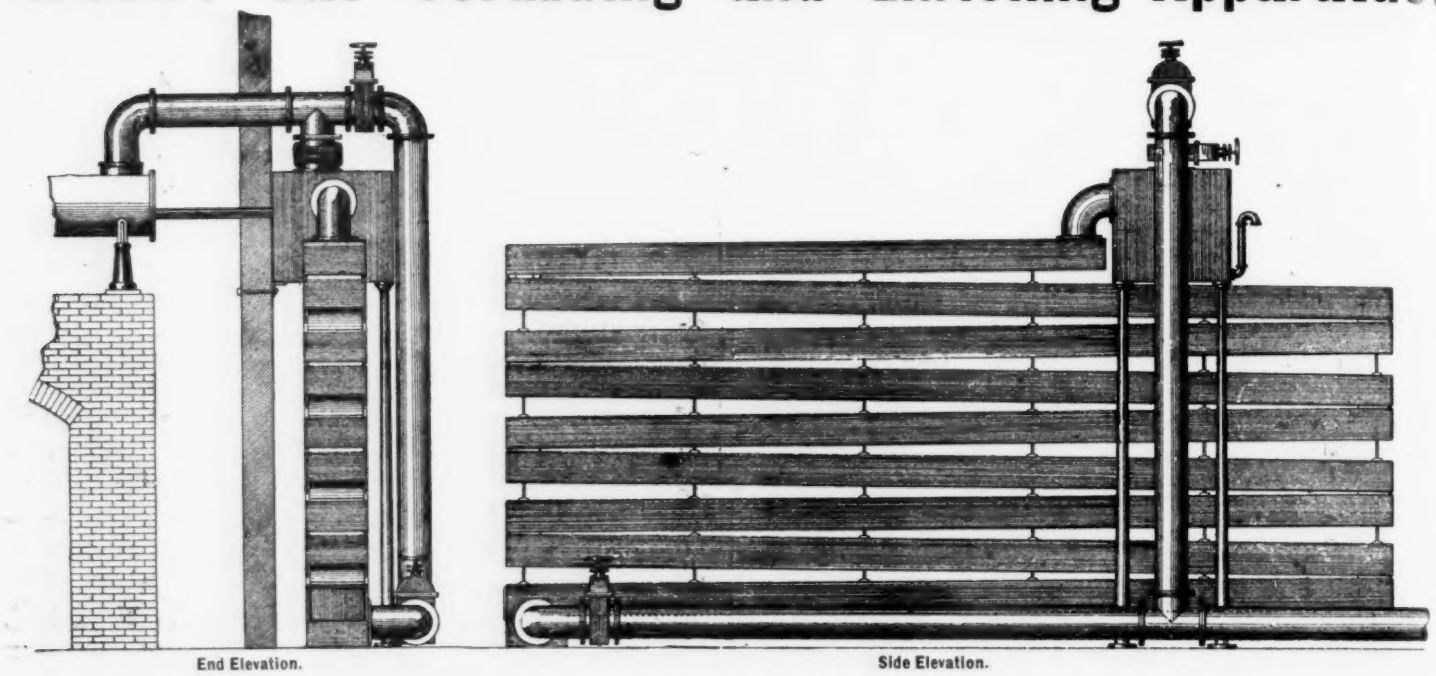

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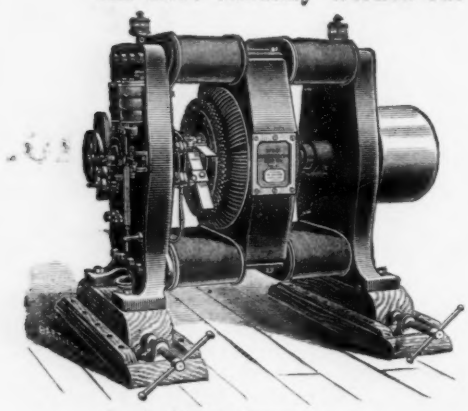

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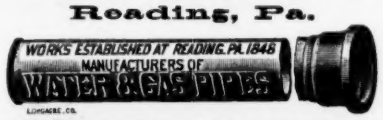

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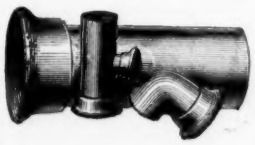

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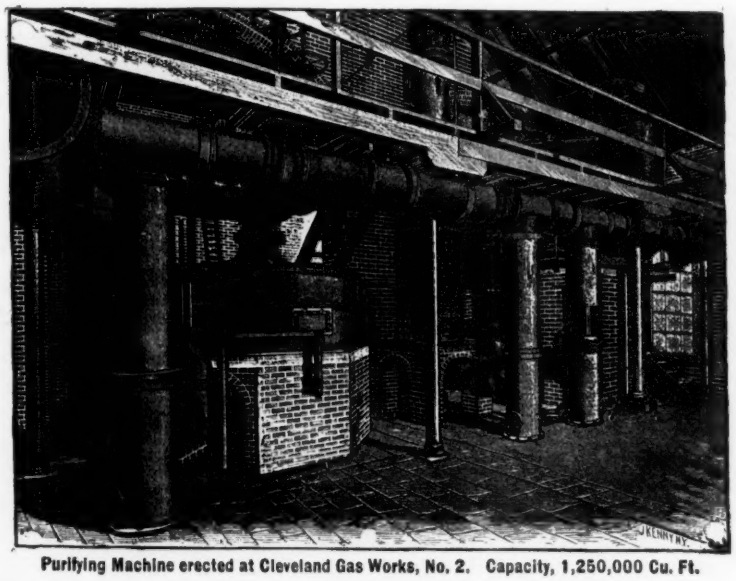

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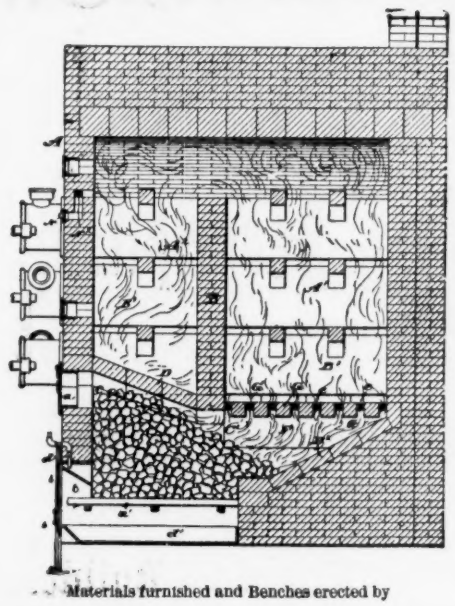

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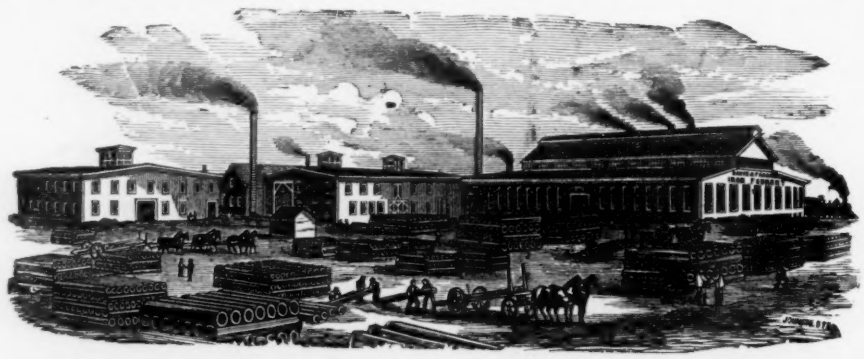

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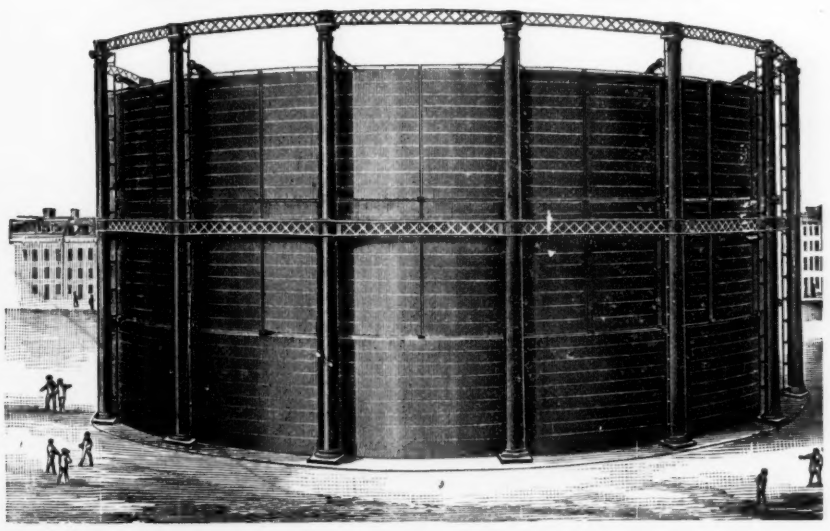

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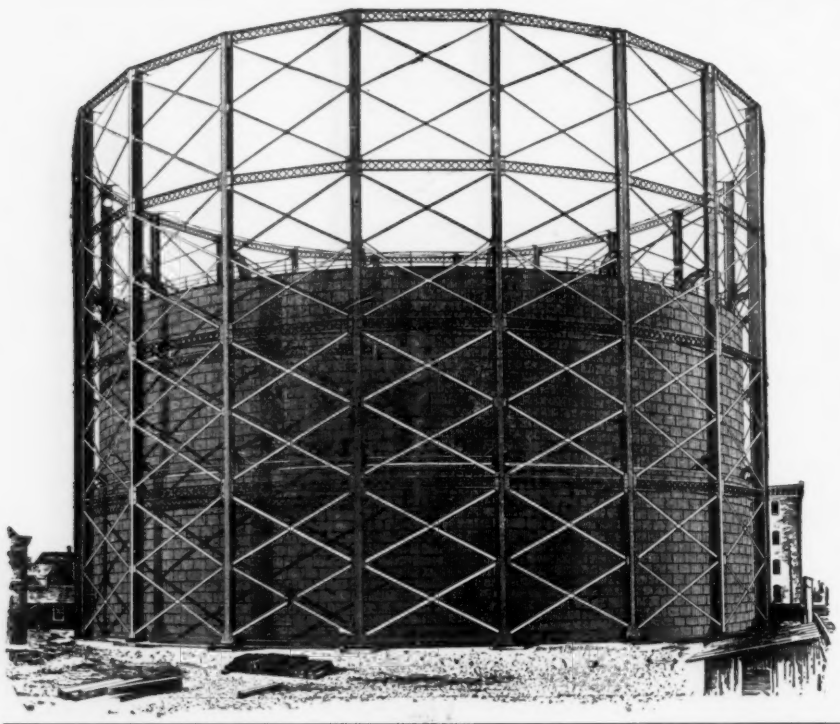

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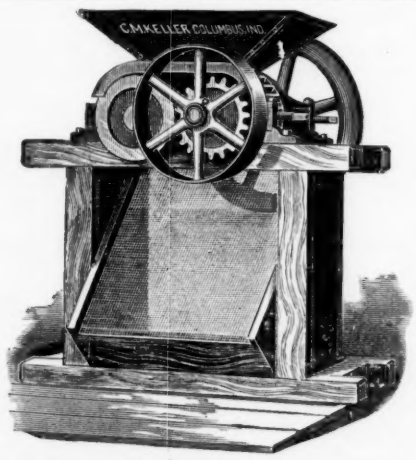

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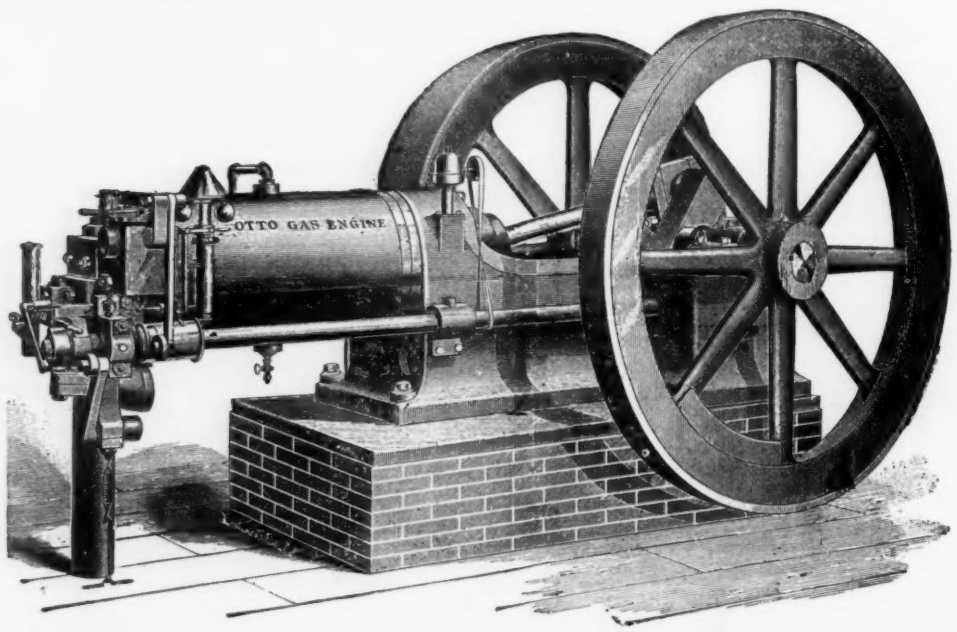
With Gas Power, **cost of fuel** is strictly **limited** to the time of use.

MANY VALUABLE AND RECENT IMPROVEMENTS.



SIZES 1-3 to 100 HORSE POWER.

Wherever Gas Companies tried Gas Power with Steam Power together in one Station, the use of Steam was subsequently abandoned or restricted, and Gas Power made to take its place.

Where Gas Companies adopt Gas Power for Electric Plants, Water Works, Sewerage, etc., they not only choose **the most economical power for their use,** but secure to themselves the **numerous advantages of increased production,** without increase of expense, and benefit thereby their entire manufacture. They induce consumers, by their example, to abandon Steam for Gas Power, and, by establishing special rates, make

Gas Power the Leading Power of To-Day,

AND SOLVE AT ONCE THE QUESTION OF FUEL GAS.

"Otto Gas Engine Works,"

SCHLEICHER, SCHUMM & CO.,

151 Monroe St. (Kent Building), Chicago. **33d and Walnut Sts., Phila.**

NEW YORK AGENCY. 18 VESEY STREET.